

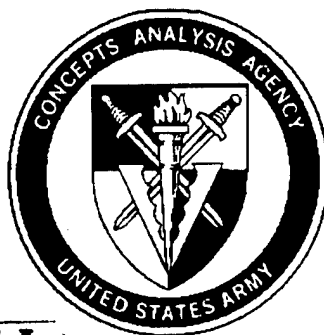
The US Army's Center for Strategy and Force Evaluation

MEMORANDUM REPORT
CAA-MR-96-80

**DETAILED CALCULATION OF
AMMUNITION, PETROLEUM, AND
EQUIPMENT REQUIREMENTS (CALAPER)
BRIEFING (DCB)**

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DECEMBER 1996



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13. ABSTRACT (Maximum 200 words) This project was developed as an in-house analysis for the purpose of providing a detailed description of the Agency's process for computing munitions and fuel consumption and losses of major end items (MEI) of equipment in a theater-level campaign. This process is used in the biennial study called Wartime Requirements (WARREQ) that is used to support Headquarters, Department of the Army, in their Program Objective Memorandum (POM) determination for war reserve materiel requirements. Book 1 of this analysis includes a detailed scripted briefing of the CALAPER process. A follow-on analysis, book 2, will illustrate the process from start to finish using selected weapon systems and their associated munitions.				
14. SUBJECT TERMS Projected wartime expenditures (PWE), projected wartime losses (PWL), projected wartime consumption (PWC) for fuel consumption, Wartime Requirements (WARREQ)			15. NUMBER OF PAGES 123	
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DETAILED CALCULATION OF AMMUNITION, PETROLEUM, AND EQUIPMENT REQUIREMENTS (CALAPER) BRIEFING (DCB)

1. SPONSOR. US Army Concepts Analysis Agency (CAA) Operational Capability Assessments - Southwest Asia (CSCA-SW).

2. BACKGROUND. Recent inquiries from Department of Defense (DOD), Headquarters, Department of the Army (HQDA), and major Army command (MACOM) analysts about the Army's process for determining war reserve requirements prompted this analysis in an effort to illuminate the assumptions, input data requirements, and program logic involved in the Wartime Requirements (WARREQ) process for determining Class III (fuel), Class V (munitions), and Class VII (major end items (MEI)) requirements based on a theater-level campaign simulation.

3. PURPOSE

a. To provide a detailed description of the CALAPER process for computing fuel and munitions consumption and losses of MEI in a theater-level campaign.

b. To illustrate the purpose from start to finish using several major weapon systems and their associated munitions as examples, i.e., the M1A1 TANK, THE AH-64C attack helicopter, the M109A3 155mm howitzer (SP), the M270 multiple launch rocket system (MLRS) and miscellaneous weapon-munition combinations such as the 155mm family of scatterable mines (FASCAM) projectiles, bulk rate items such as a charge, demo, blk, C4 1 1/4 lb, 105mm smoke and illumination cartridge, M16A2 rifle, 5.56mm ball and tracer cartridge, and the M21 sniper rifle, 7.62mm cartridge (historical).

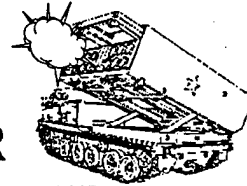
4. OBJECTIVE. To develop a detailed CALAPER briefing to describe the process, to include detailed briefings of the four major subroutines of the process: (1) the Munitions Consumption Program (MCON), (2) the Equipment Loss Consolidator Program (ELCON), (3) the Fuel Consumption Program (FCON), and (4) the Quick Computation Program (QUICK COMP).

5. ASSUMPTIONS. All assumptions, data input files, and guidance provided by the sponsors for previously completed studies will remain the same. Validation of the Wartime Requirements process by the Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS) Working Group, which was held at CAA in February 1996, and briefed at the Senior Army Leadership Conference (the Requirements Review Council) in February 1996, is the basis for all those assumptions used in the recently completed WARREQ FY 2003 analysis.

6. ESSENTIAL ELEMENT(S) OF ANALYSIS. What are the detailed descriptions of the CALAPER requirements process and each of its supporting subroutines? The EEAs are provided in the main body of the report, and the accompanying appendices for each subroutine of the process.

8. COMMENTS AND QUESTIONS may be sent to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-SW, (301) 295-6955, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.

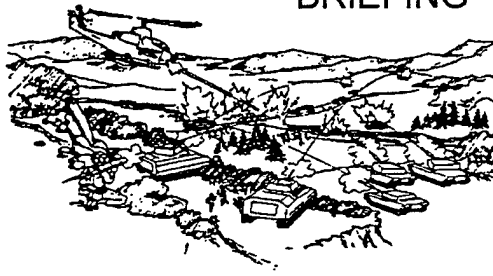
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DETAILED CALAPER

(CALCULATION OF AMMUNITION, PETROLEUM AND
EQUIPMENT REQUIREMENTS

BRIEFING



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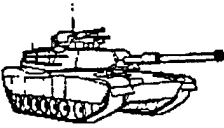
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BRIEFING PURPOSE

❶ To provide a detailed description of the CALAPER process for computing munitions and fuel consumption, and losses of major end items (MEI) in a theater-level campaign.

❷ To illustrate the process from start to finish using several major weapon systems and their associated munitions as examples:

- M1A1 tank, 120mm main gun
 - » M830 cartridge, HEAT-MP-T
 - » M829 cartridge, APFSDS-T
- AH-64 attack helicopter
 - HELLFIRE
 - 2.75-in, rockets
 - 30mm, cannon
- M109A3, 155mm howitzer (SP)
 - M107, projectile, H.E.



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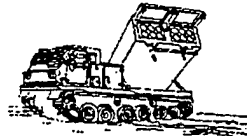
This is a detailed briefing describing the CALAPER process for determining munitions, fuel, and major end item (MEI) requirements in a theater-level campaign.

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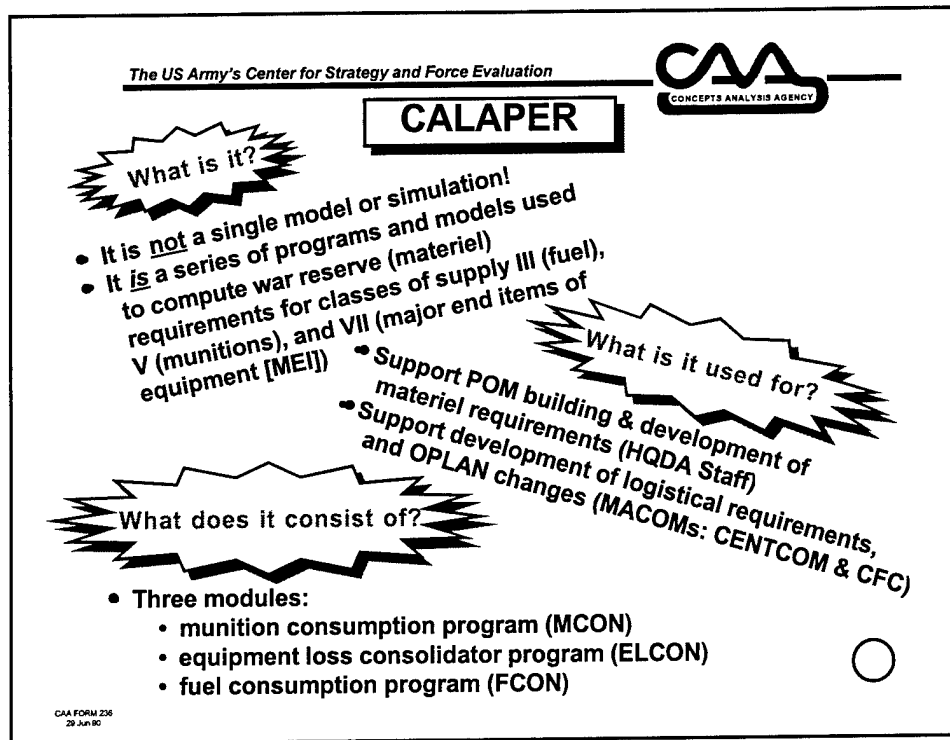
BRIEFING PURPOSE (cont)

- M109A3 155mm howitzer
 - » M483A1, DPICM projectile
 - » M989, SADARM projectile
- M270, MLRS launcher
 - » 298mm, DPICM rocket
- Miscellaneous
 - » 155mm FASCAM projectile
 - » Charge, demo, blk, C4 1 1/4 lb (bulk rates)
 - » 105mm, smoke & illum cartridge
 - » M16A2, rifle, 5.56mm ctg, ball & tracer
 - » M21, sniper rifle, 7.62mm, match, M852, ctg

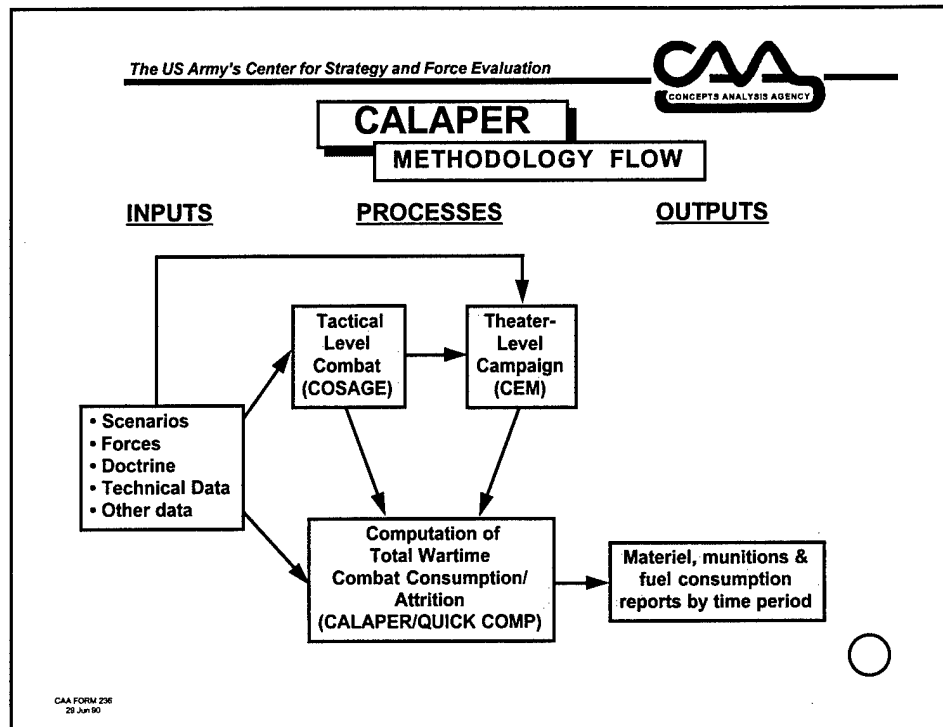


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This chart describes what CALAPER is, and is not. Also, what it is used for and what it consists of, i.e., subroutines or modules.



The process consists of basically three phases as shown above: input preparation; running simulations/processes; and analyzing and preparing the outputs (or requirements results). Input gathering and file preparation are time-consuming, but extremely critical. Data such as the specific scenarios to be simulated, the appropriate force structures (US, allies, and enemy forces), specific weapon systems and munitions to be modeled, the timeframe in question, i.e., near-term or outyear of the Program Objective Memorandum (POM) cycle, etc., must all be coordinated with the Headquarters, Department of the Army (HQDA) Staff, Training and Doctrine Command (TRADOC), Headquarters (HQ) Army Materiel Command (AMC), HQ Army Materiel Systems Analysis Activity (AMSAA), major Army commands (MACOMs), and must be closely monitored and approved by the study sponsor, which is normally Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS), HQDA (DAMO-FDL).

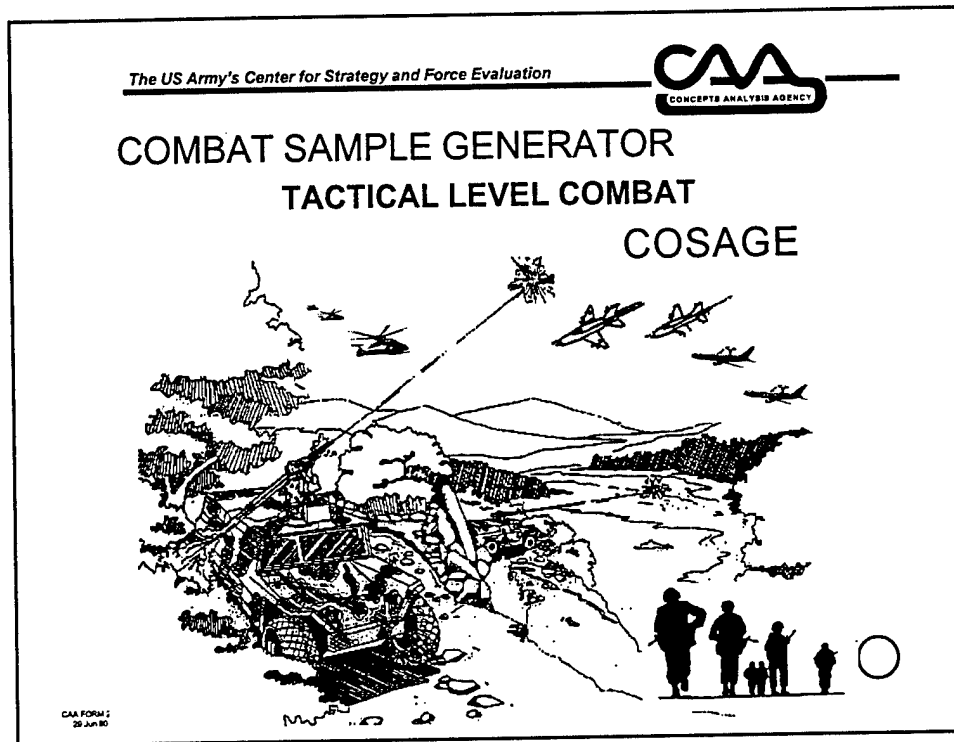
The process requires input from the two combat simulations, the tactical-level simulation Combat Sample Generator (COSAGE) and the theater-level simulation Concepts Evaluation Model (CEM). Output from these simulations, plus other input files prepared by the CALAPER analyst are then processed through the system to produce detailed projections of wartime munitions and fuel consumption, and equipment losses for the length of the campaign, normally in 10-day time increments.

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<div style="border: 2px solid black; padding: 5px; text-align: center;"> INPUT DATA REQUIREMENTS </div>	
<u>Type Data</u>	<u>Sources</u>
• Scenario	<ul style="list-style-type: none"> • Defense Planning Guidance (DPG) (Illustrative Planning Scenarios - IPSs) • CINCs - OPLANS
• Forces	US Army - DA Staff, ODCSOPS, ODCSLOG USMC - (MAFs, MEFs, BLTs, etc.) USAF - CAA LNO (Wings, Sqdns, Number and type aircraft) Enemy/allied - ODCSINT, ITAC/NGIC
• Doctrine	• HQDA, TRADOC, DCSINT, USAF, USMC
• Technical Data	• USAMSAA, DCSINT, TRADOC, FISOs
• Other	• Janes Wpn Series, FMs, TMs, Service Reps, Program Managers, etc.

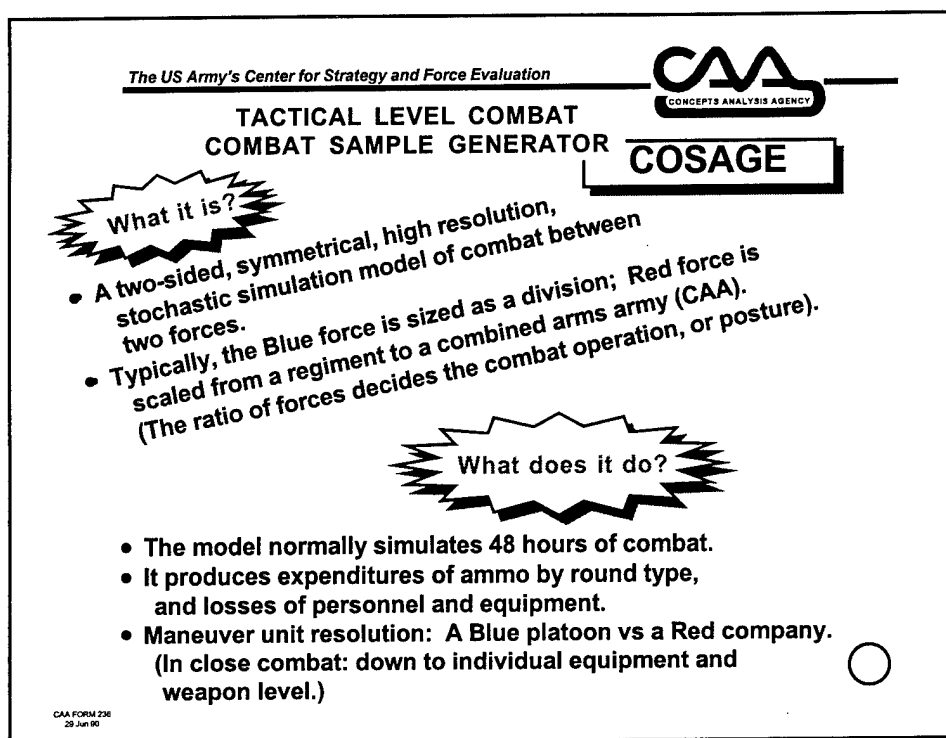
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This chart illustrates the variety of input data required to run CALAPER and the normal sources of that data. These data are formally reviewed for every study and are coordinated every 3 or 4 years either by direct CAA visits to the various staff agencies and MACOMs, or by a HQDA-sponsored workshop or seminar and are published in an official CAA document for review and approval. The last workshop was sponsored by ODCSOPS (DAMO-FD) (chaired by BG Riggs), and the entire munitions requirements process was validated at the Requirements Review Council and the Chief of Staff of the Army (CSA) in February 1996.



This chart shows the first combat simulation needed to run CALAPER:
COSAGE (tactical-level combat).





This chart describes what COSAGE is and what it does in the CALAPER process. Basically, the simulation evolves about a Blue division-sized force against an opposing Red force. The size of the Red force determines the combat operation or "posture." This simulation provides the weapon-on-weapon interactions for the combat simulation in a theater campaign context, usually for a 48-hour period of time. It produces munitions expenditures by type and equipment and personnel losses for each posture. Normally, 15 to 20 replications are required for each posture because of the stochastic nature of the simulation to produce valid average results. Considering that there are usually 6 postures x (15 or 20 replications) x 3 forces (US, allied, threat), there could be almost 270-360 COSAGE runs required to support each campaign.

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REPRESENTATIVE COSAGE COMBAT SAMPLES
(6 BASIC TYPES)

- * **Blue Defense:** (Red force attacking a Blue prepared defense.)
Intense
(RAPD) 
- * **Blue Delay:** (Blue force conducting a delay or a defense on alternate or successive defensive positions against an attacking Red force.)
(RADL)
- * **Blue Hasty:** (Blue force in a hasty defense against an attacking Red force.)
Defense
(RAHD)
- * **Blue/Red At Parity:** Red & Blue forces are at parity and both are in defense positions. Both sides are conducting probes, patrols, recon, and arty duels.
(STATIC)
- * **Blue Attack:** Multiple Blue divisions conducting an attack against a Red division in a prepared defense.
(BAPD) 

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This chart and the next show the typical COSAGE postures, their COSAGE abbreviations, and a brief description of the combat operation (posture).

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REPRESENTATIVE COSAGE COMBAT SAMPLES (cont)

- * **Red Hasty Defense:** Multiple Blue divisions conducting an attack against a Red division in a hasty defense. (RAPD)
- * **Others:** May be modeled as necessary, i.e., DMZ (in NEA), Red delay, etc.
- * Results of these simulations are called **COMBAT SAMPLES**
- * A combat sample - represents the expected results, during a theater campaign, for a division in combat for 48 hours of the posture simulated, (i.e., COSAGE boards.)



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COMBAT SAMPLE (COSAGE) STRUCTURE

The COSAGE Model consists of over 270 processes, events, and routines.


- COSAGE is a discrete event simulation, with stochastic phenomenon modeled through events and processes.
- Events are discrete in that they occur at a specific time, (i.e., D-day, H-hour, etc.).
- Processes occur over a period of time and are controlled by the model clock (or model logic).
(Blue attack, defense, or delay, etc., etc.)
- Both events and processes are transparent to the user.



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Shown here is a description of the 270 COSAGE processes, events, and routines.

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COSAGE EVENT TYPES

1. The Activate Attack (ACT.ATK)
2. The Activate Defense (ACT.DEF)
3. The Activate Move to Coordinate (ACT.MOVCOR)
4. The Activate Move a Distance (ACT.MOVDIS)
5. The Activate Reinforcements (ACT.REINF)
6. The Air Defense Engagement (AD.ENGAGEMENT)
7. The Artillery Occupation (ARTY.OCCUPATION)
8. The Battle Ended (BTL.ENDED)
9. The Counterfire Radar Activation (CFR.ACTIVATION)
10. The Counterfire Radar On (CFR.ON)
11. The Counterfire Radar Off (CFR.OFF)



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The next three charts show the 33 event types simulated in COSAGE. These events control the movement of units on the battlefield. The timing mechanisms, or routines, exist as part of the SIMSCRIPT II.5 program library. The timing routines are conceptualized as the model's clock, and it advances according to the embodied logic, calling into execution the discrete events at the appropriate time(s) during the simulation.

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COSAGE EVENT TYPES (cont)

- 12. The Counterfire Radar Operator (CFR.OPERATOR)
- 13. The Change Weather (CHANGE.WEATHER)
- 14. The Dequeue Old Sortie Queue (DQ.OLD.SORTIE.QUEUE)
- 15. The Engagement (ENGAGEMENT)
- 16. The Get Next Order (GET.NX.ORDER)
- 17. The Helo Depart Battle (H.CDEPART.BATTLE)
- 18. The Helicopter Engagement (HELO.ENGAGEMENT)
- 19. The Initiate Preplanned Close Air Support (INIT.PREPLAN.CAS)
- 20. The Move (MOVE)
- 21. The Passive Detection Base Activation (PDB.ACTIVATION)
- 22. The Passive Detection Base Operator (PDB.OPERATOR)



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COSAGE EVENT TYPES (cont)

- 23. The Send Team (SEND.TEAM)
- 24. The Start Artillery Movement (START.ARTY.MOVEMENT)
- 25. The Start Battle (START.BATTLE)
- 26. The Start Move (START.MOVE)
- 27. The Stop Artillery Movement (STOP.ARTY.MOVEMENT)
- 28. The Schedule Artillery Movement (SCHEDULE.ARTY.MOVEMENT)
- 29. The Update Location (UPDATE.LOC)
- 30. The Change Light (CHANGE.LITE)
- 31. The End Simulation (END.SIM)
- 32. The Position Report (POSITION.REPORT)
- 33. The Set Debug (SET.DEBUG)



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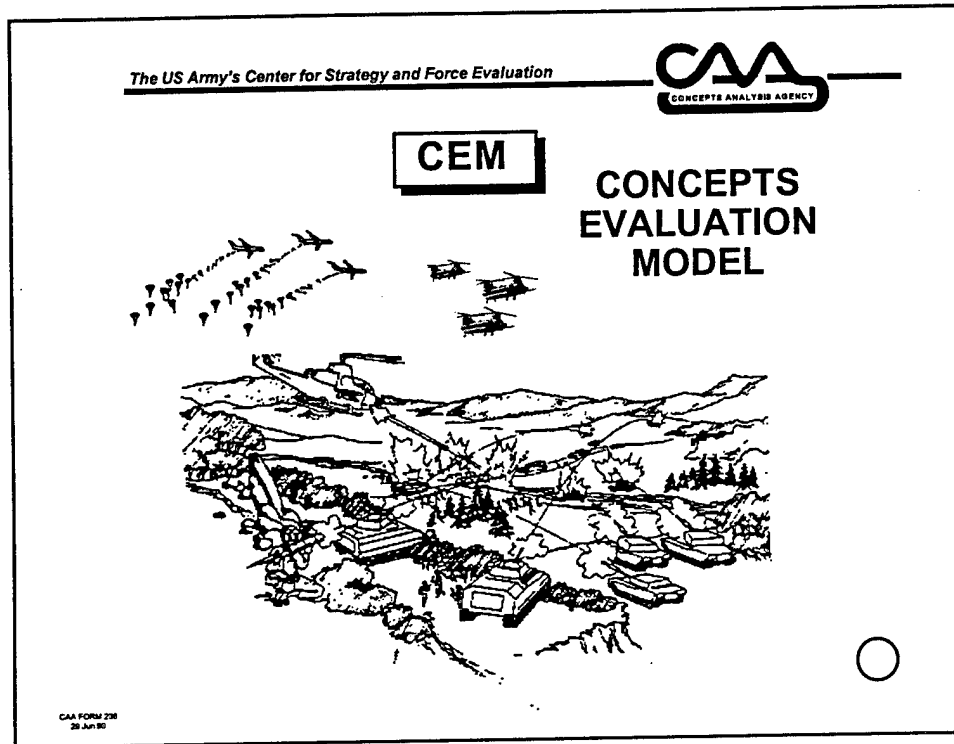
COSAGE PROCESS TYPES

1. The Aircraft Attack Target (AC.ATK.TGT)
2. The Assessment (ASSESSMENT)
3. The Close Air Support Mission (CAS.MISSION)
4. The Fire Mission (FIRE.MISSION)
5. The Forward Observer (FORWARD.OBSERVER)
6. The Helicopter Arrive Battle (HC.ARRIVE.BATTLE)
7. The Helicopter Return to FARRP) (HC.RETURN.FARRP)
8. The Helicopter Fire Process (HELICOPTER.FIRE)
9. The Helicopter Target Acquisition Process (HEL.TGT.ACQUISITION)
10. The Mine Assessment (MINE.ASSESS)
11. The Shoot Out (SHOOT.OUT)
12. The Target Report (TARGET.REPORT)
13. The Withdraw (WITH.DRAW)

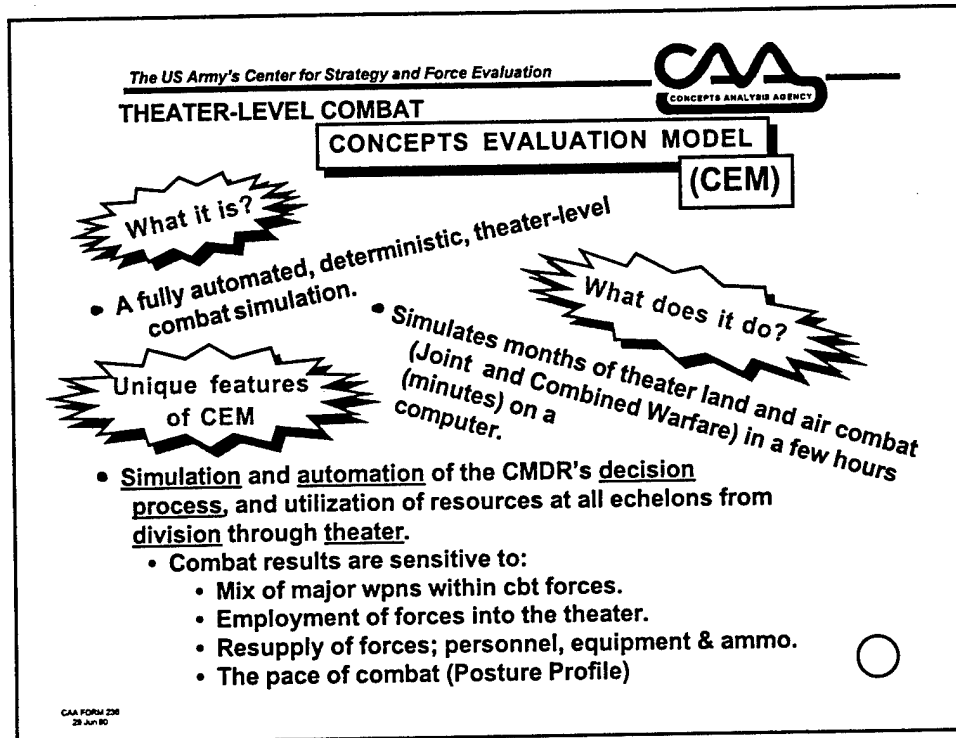
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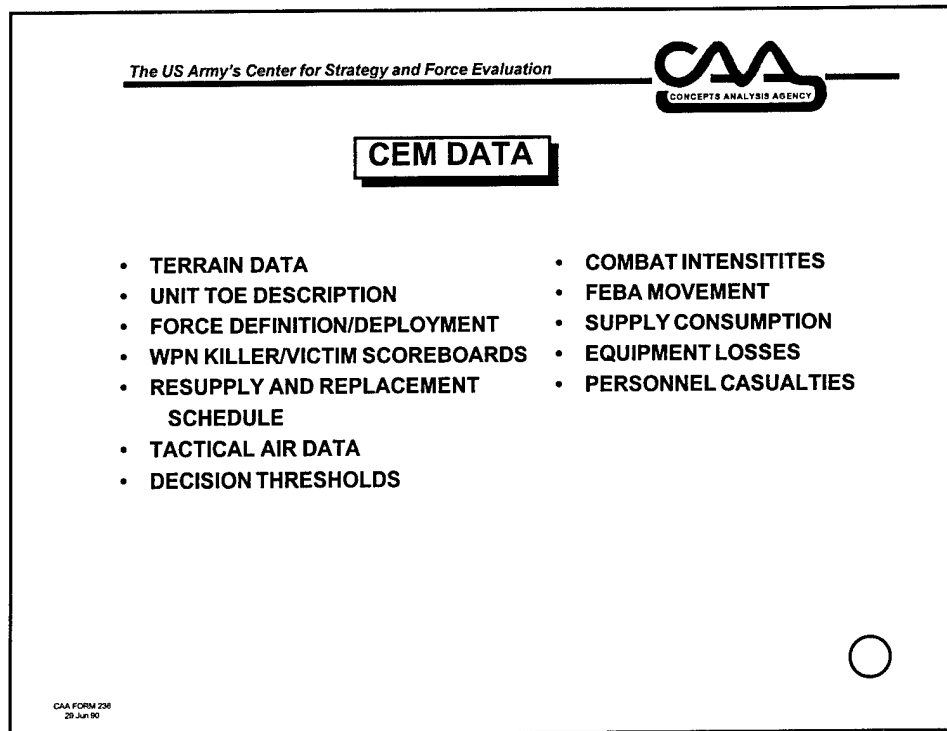
This chart lists the 13 COSAGE process types. Modeling processes can be thought of as the execution of a series of events. The big difference between the two is that an event occurs *instantaneously* in time, whereas a process requires a *certain amount of time* to execute.



This is the next combat simulation needed to execute CALAPER (the theater combat simulation, CEM).



This chart describes what CEM is, what it does, and some of its unique features.



This chart lists some of the input data required to execute CEM and a few of the major output files created from that simulation.

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OPERATIONS BY ECHELON

THEATER

- AIR BATTLE ASSESSED
- CAS ALLOCATED TO ARMIES
- REINFORCEMENT GS ARTY BNS ASSIGNED
- REPLACEMENT PERS, EQUIP, AND SUPPLY ALLOCATED
- EQUIPMENT REPAIRED/WOUNDED TREATED


ARMY

- MISSION SELECTED
- CORPS SECTOR ASSIGNED
- REINFORCEMENT/RESERVE DIVISIONS TO CORPS
- GS ARTY/CAS ALLOCATED TO CORPS
- RESERVE DIVISIONS & RED REPLACEMENT POOLS

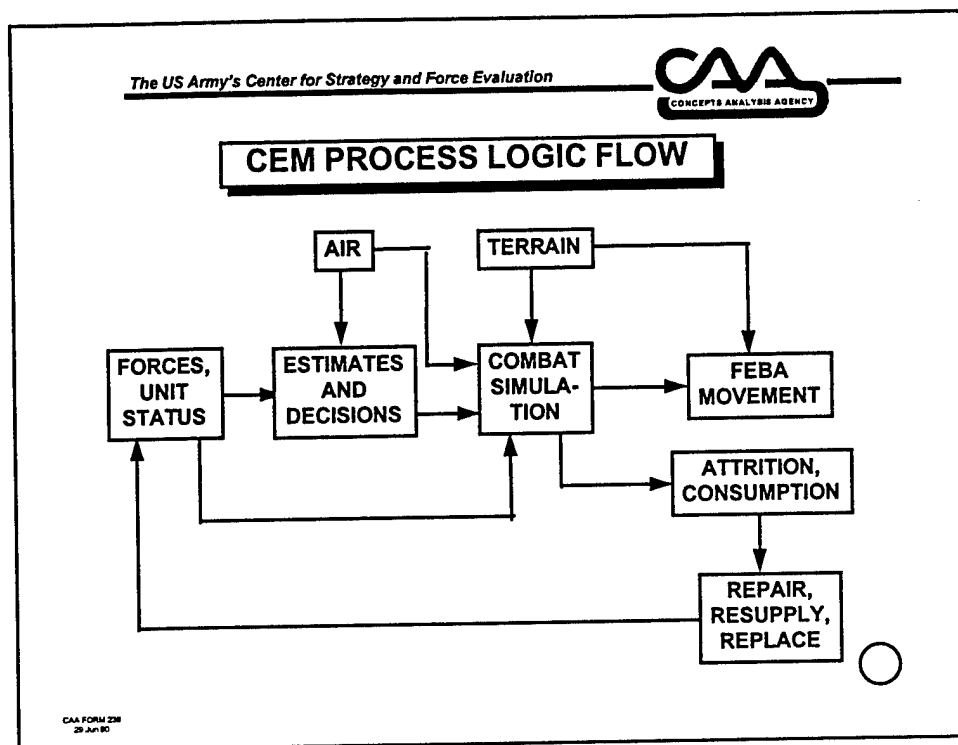


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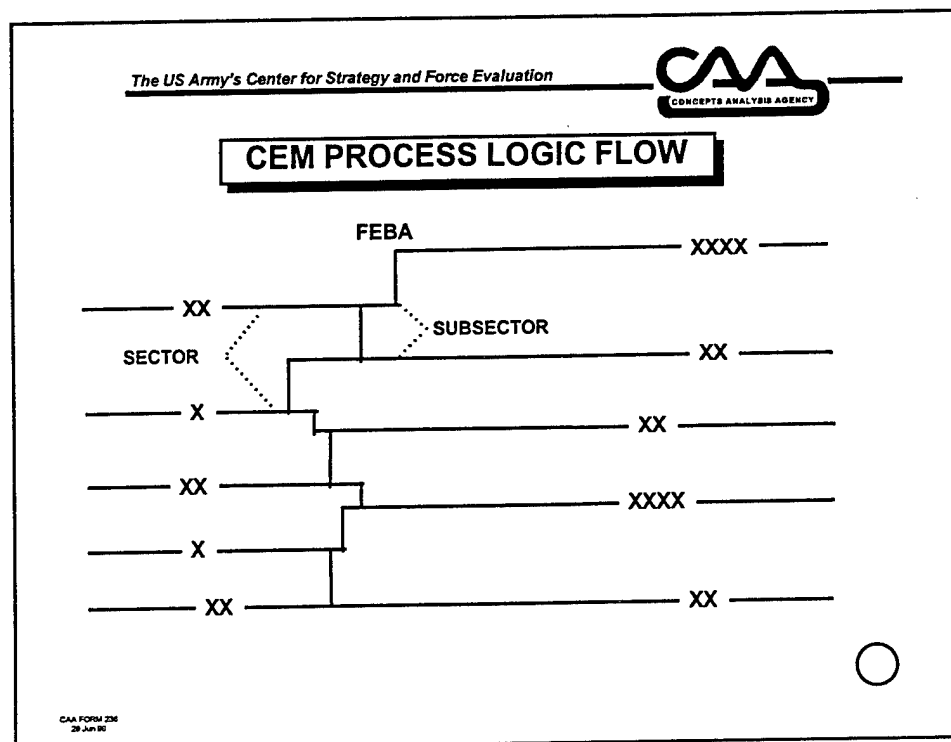
The next two charts describe the tactical operations by echelon from the theater level down to the division.

<div><div>The US Army's Center for Strategy and Force Evaluation</div><div> CONCEPTS ANALYSIS AGENCY</div></div> <div>OPERATIONS BY ECHELON (CONTINUED)</div> <div><u>CORPS</u><ul style="list-style-type: none">• MISSION SELECTED• RESERVE DIVISIONS ASSIGNED/RECONSTITUTED• DIVISION SECTORS ASSIGNED• GS ARTY/CAS/CAV ALLOCATED TO DIVISIONS<hr/></div> <div><u>DIVISION</u><ul style="list-style-type: none">• BRIGADE MISSIONS SELECTED• GS ARTY/CAS/CAV ALLOCATED TO BRIGADES• GROUND BATTLE ASSESSED• REPLACEMENT PERS, EQUIP AND SUPPLY ACCOMPLISHED<div>○</div></div> <div><small>CAA FORM 228 28 Jun 85</small></div>

Periodically at each echelon, an estimate of the situation is made, and, on the basis of this estimate, a mission is selected and fire support is allocated to subordinate commands. This sequence continues down to the brigade level, where the outcome of each brigade engagement is determined. The results of such an engagement are a local change in the forward line of own troops (FLOT) and a degradation in the condition or status of the engaged forces, i.e., a loss of personnel and materiel and a consumption of supplies. The condition of the forces may also be enhanced by reinforcements and/or resupply. These results are then aggregated at the various echelons where they are used for the subsequent estimates of the situation.



This chart pictures the flow of logic in the theater simulation.



CEM uses a simplified representation of the battlefield. Movement is measured in kilometers (km) (minimum distance equals 1/10 km). Distances along the front are measured in minisectors (as shown above). Terrain can be of four types.


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CEM TERRAIN TYPES		
TYPE	DESCRIPTION	
A -	Flat to gently rolling w/minimum timber. Excellent tank country	
B -	Marginal for track and wheel vehicles because of soil conditions or vegetation	
C -	Tanks and wheeled vehicles must remain on roads because of steep slopes, dense forests, or swamps	
D -	Some major obstacle, natural or manmade	

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This chart lists the terrain types that can be represented in CEM and their description.

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UNIT DEFINITION

- NUMBER OF MAJOR WEAPONS BY TYPE
- NONCREW PERSONNEL STRENGTH
- AUTHORIZED LOAD OF SUPPLIES
- SUPPLY CONSUMPTION RATES

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CEM simulates combat only between combat forces or units. This combat is normally between Blue brigades and Red divisions or fractions thereof. Each unit (Blue and Red) is defined by the number and variety of its battalions or regiments. This chart lists the items that describe a unit. The maximum number of types of battalions or regiments that can be simulated in a given run is 50.

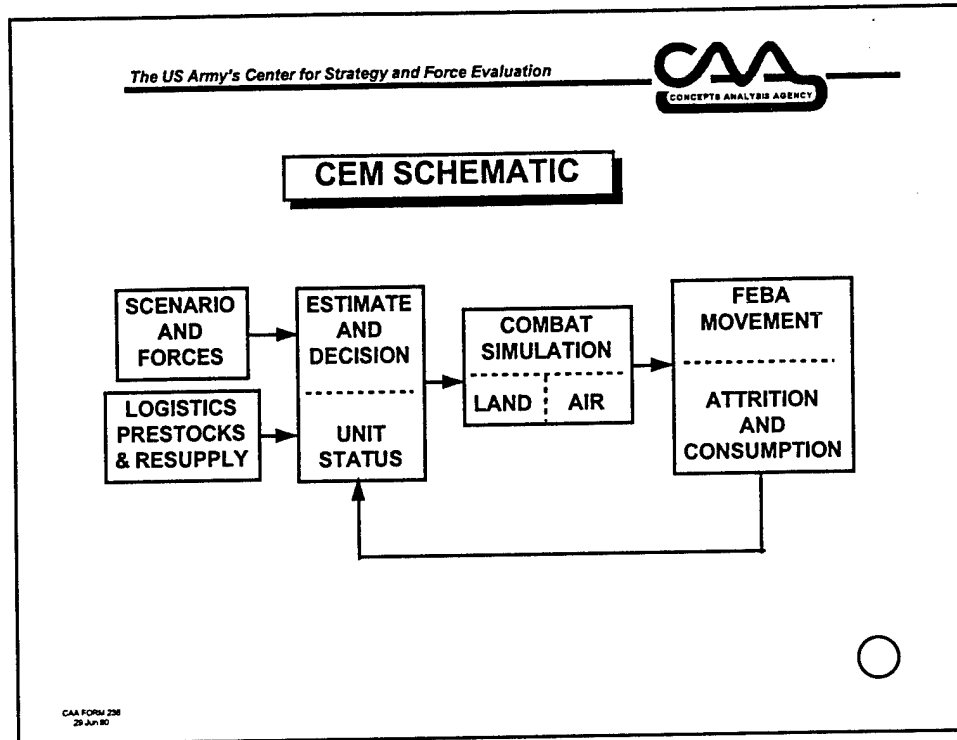
<p>The US Army's Center for Strategy and Force Evaluation</p> <p>CAA CONCEPTS ANALYSIS AGENCY</p> <p>MAJOR WEAPON DEFINITION</p> <ul style="list-style-type: none">● KILLER/VICTIM SCOREBOARDS● CREW STRENGTH● MUNITIONS ROUND WEIGHTS● BREAKDOWN RATES● REPAIRABILITY FACTORS● SUPPLY RATIONING FACTORS <p>CAA FORM 226 28 Jun 80</p> <p>○</p>
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Total weapon types that can be simulated in CEM are limited to 50 per side, i.e., 12 tank types, 12 light armor types, 12 antitank/mortar types, 5 helicopter types, and 8 artillery types. There is also one slot for personnel (individual weapon carriers) and a 51st slot dedicated to tactical air. Each weapon system is limited to two munition types (or pots) in the simulation. Ammo pot 1 is normally the munition for the major weapon system, i.e., the 120mm cartridge for the M1A1 tank. Pot 2 would contain the other weapon systems such as the .50 caliber machinegun and the 7.62mm machinegun cartridges rolled together.

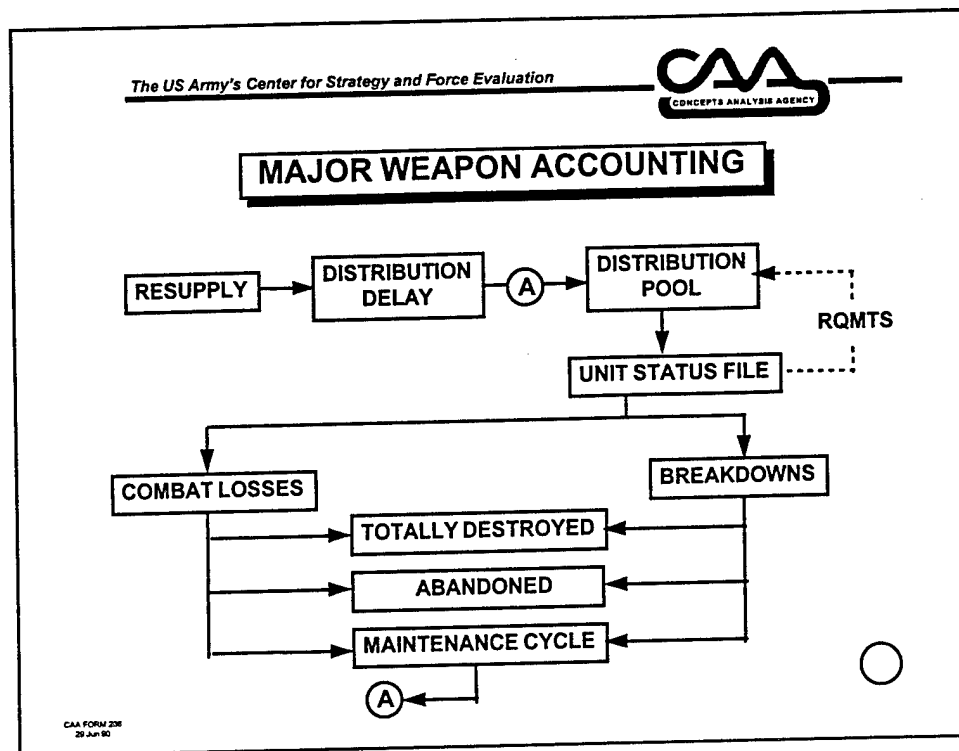
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CEM TIME PERIODS	
<u>ECHELON</u>	<u>TIME PERIOD</u>
THEATER CYCLE	4 DAYS
ARMY CYCLE	2 DAYS
CORPS CYCLE	1 DAY
DIVISION CYCLE	1/2 DAY

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Each echelon above brigade (regiment) has an associated time period, roughly the time within which a change of mission is unlikely to occur. Estimates of the situation are made once each period at the corresponding echelon.



This chart shows the flow of simulated actions, decisions, and results for opposing forces in CEM.




This chart illustrates how the status of major weapon systems is maintained in the simulation.

<div data-bbox="443 275 876 302"><i>The US Army's Center for Strategy and Force Evaluation</i></div> <div data-bbox="967 254 1143 327"></div> <div data-bbox="558 340 1018 378">ENGAGEMENT CHARACTERISTICS</div> <div data-bbox="487 436 776 470">TYPE OF ENGAGEMENT</div> <div data-bbox="487 508 862 543">TYPE OF DEFENSIVE POSITION</div> <div data-bbox="487 581 906 619">FORCES/WEAPONS ON EACH SIDE</div> <div data-bbox="487 657 716 693">TYPE OF TERRAIN</div> <div data-bbox="1166 842 1218 892"></div> <div data-bbox="381 915 443 938"><small>CAA FORM 235 28 Apr 90</small></div>

Generally speaking, combat action is resolved to brigade level, and the brigade-level engagement is an aggregated summary of the combat activities occurring in a (brigade) sector during a division period. An engagement is characterized by these elements.

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CONCEPTS ANALYSIS AGENCY

ENGAGEMENT RESULTS

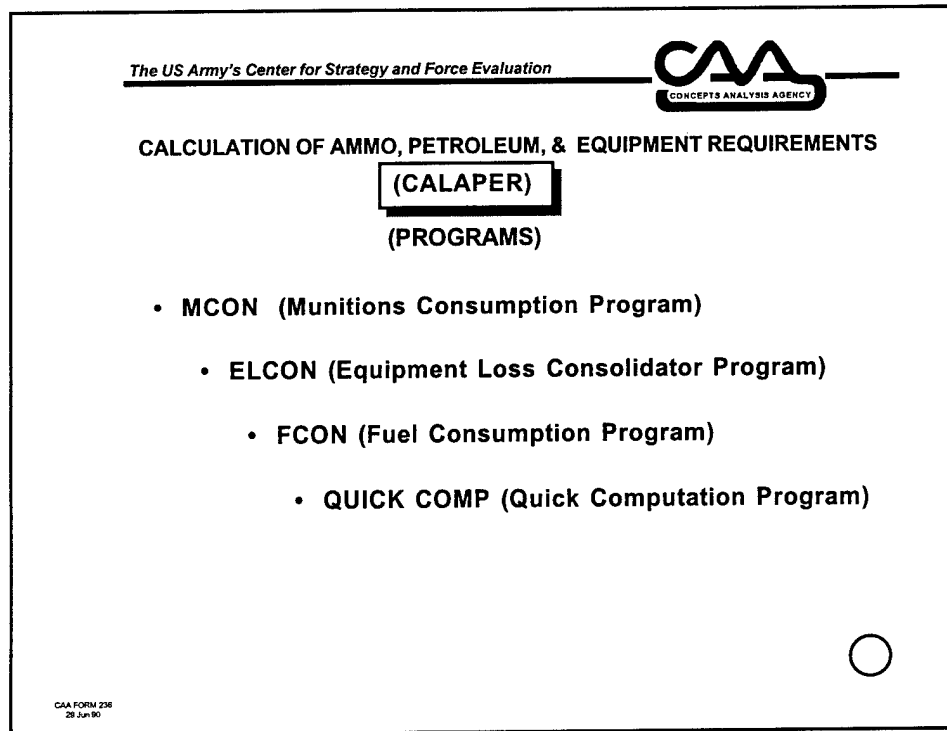
- COMBAT LOSSES
 - PERSONNEL
 - WEAPONS
 - EQUIPMENT
- LOCAL FEBA MOVEMENT
- EXPENDITURES
 - AMMUNITION
 - POL
 - OTHER SUPPLY

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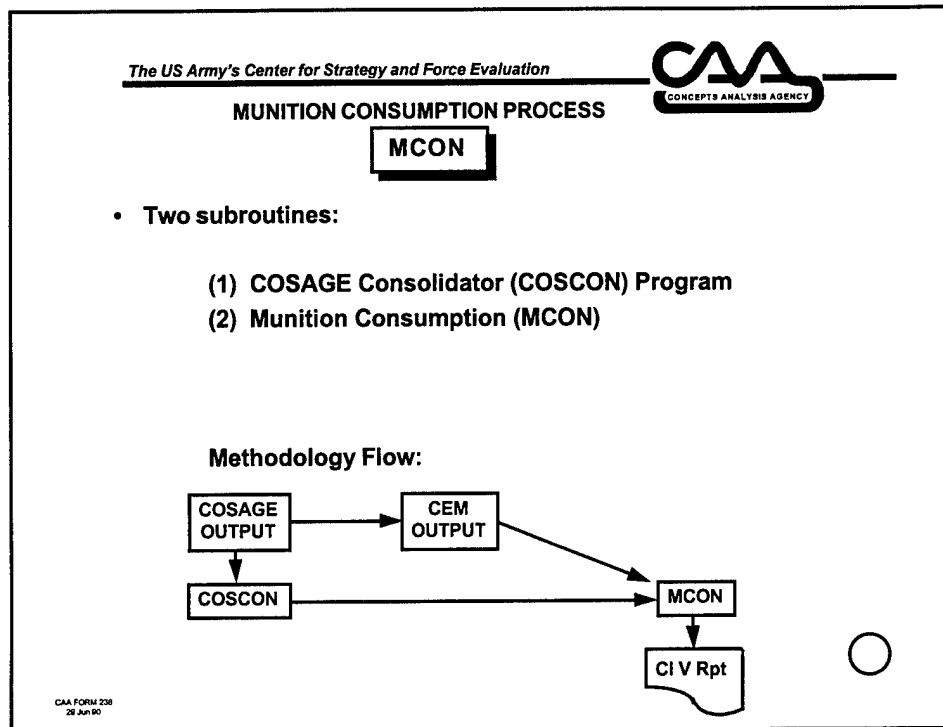
This chart describes the engagement results that are accumulated for each engagement occurring during a division cycle.

<p>The US Army's Center for Strategy and Force Evaluation</p> <p>CEM DOES NOT REPRESENT</p> <p>ENVELOPMENT OR BYPASS OPERATIONS</p> <p>ANTICIPATION OF EXPECTED EVENTS</p> <p>DETAILED REAR AREA OPERATIONS</p> <p>WEATHER - OBSCURATION</p> <p>COMMUNICATIONS - EW</p> <p>CHEMICAL OR NUCLEAR WARFARE</p> <p>○</p> <p>CAA FORM 236 28 Jun 90</p>	<p>CAA CONCEPT ANALYSIS AGENCY</p>
--	---

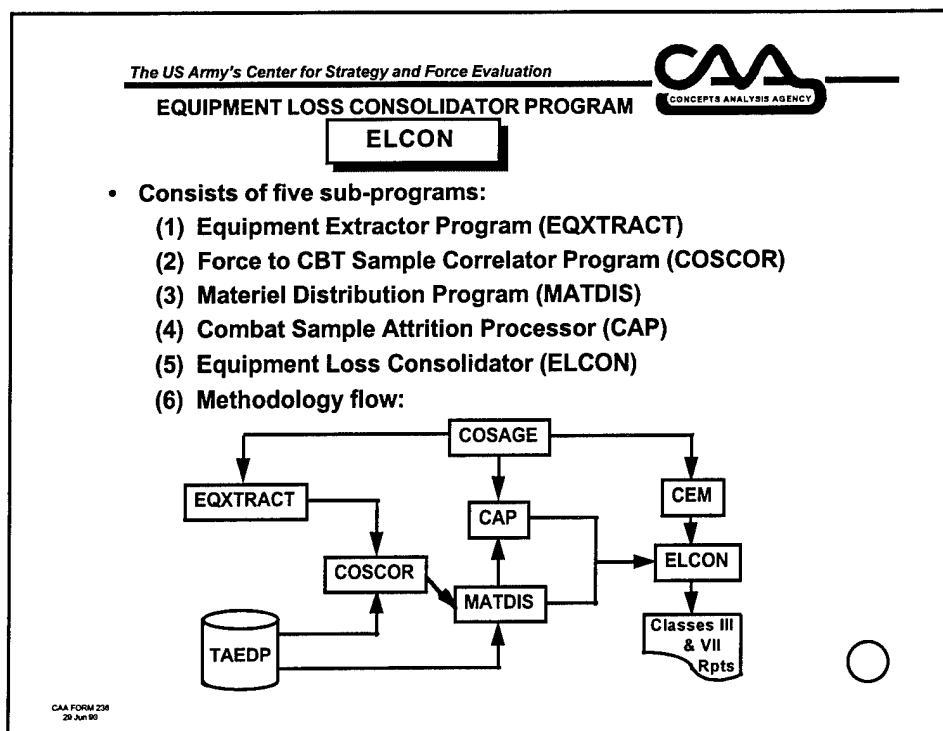
In summary, CEM is a fully automated, deterministic, theater-level combat simulation. It is controlled by simulating the commander's decision from theater level down to the division commander and is resolved at brigade-level engagements. It *does not* represent those types of operations/conditions listed on this chart.



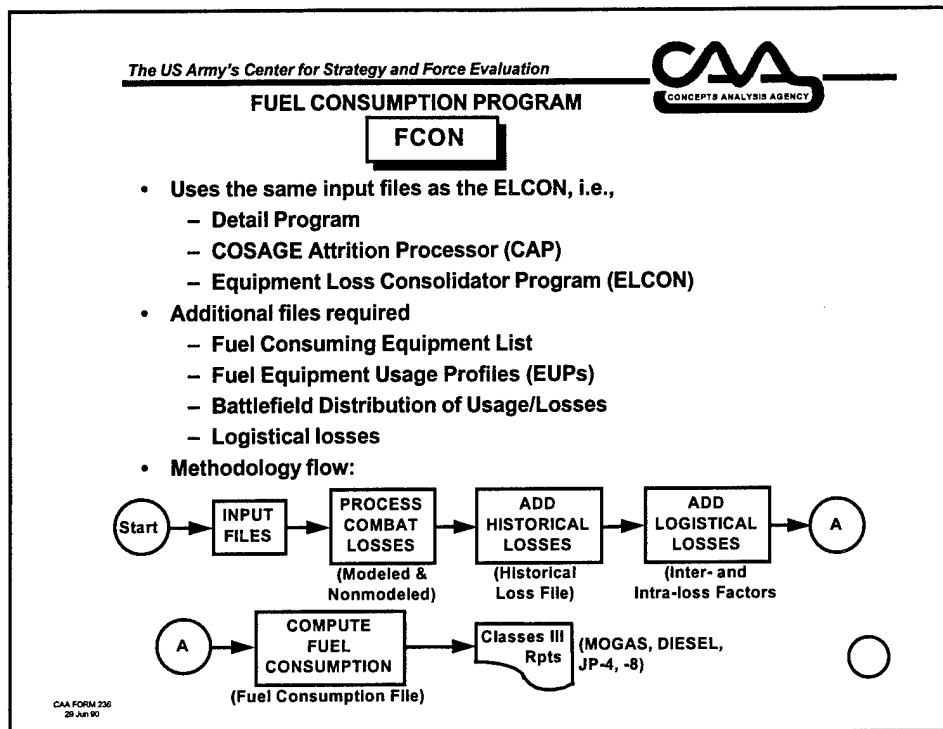
Once all of the required input files are built and we have final CEM runs and the necessary COSAGE files for all of the appropriate postures, we can then execute CALAPER. This chart describes the subroutines contained in the CALAPER process. The last subroutine listed, QUICK COMP, is a self-contained program in itself. It is a facsimile of the entire CALAPER process. We will discuss this routine in more detail later in the briefing. The next three charts briefly describe the three subroutines, or programs, that produce munitions, fuel, and equipment requirements at the line item number (LIN), Department of Defense Ammunition Code (DODAC), and type of fuel level of detail.



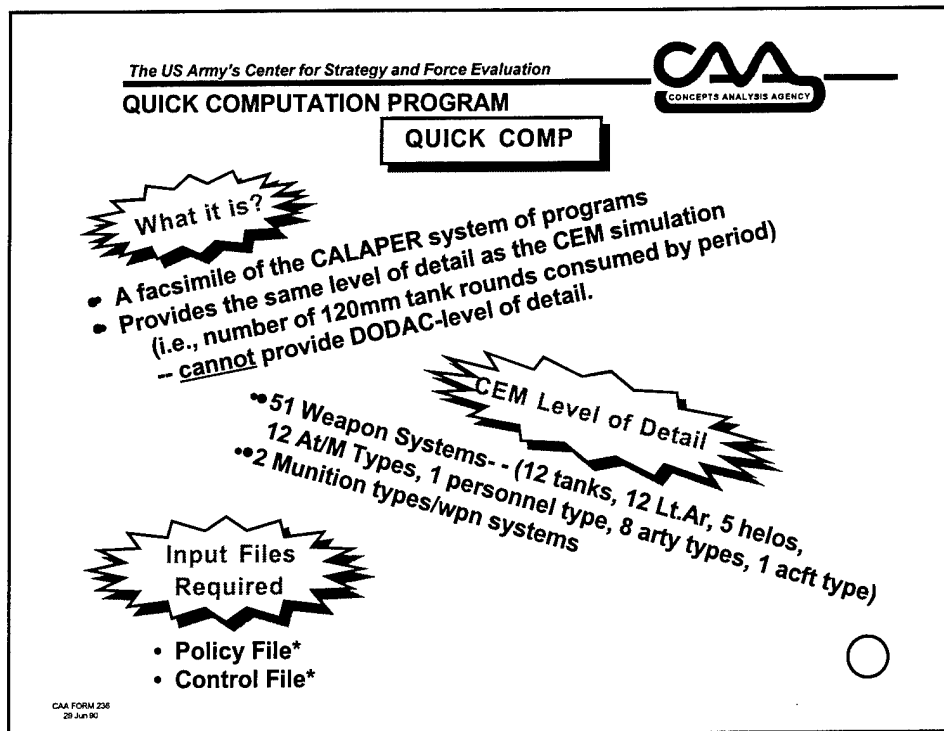
This chart lists the subroutines of the Munition Consumption (MCON) process and shows the methodology flow of data through the system. The end product is the Class V report, which provides munitions consumption for some 400+ weapons/munitions combinations for the entire theater campaign in 10-day time increments. For more details on the MCON, see Appendix C.




This chart lists the five subroutines of the Equipment Loss Consolidator (ELCON) program and shows the methodology flow of data through the system. The end product is the equipment loss report for the entire campaign in 10-day time increments. The fuel consumption program (Class III) is automatically executed along with the ELCON if certain additional files are developed. That process is discussed on the next chart. Approximately 1,700 line item number (LIN) pieces of equipment are included in the equipment master LIN list for which requirements are generated. For more details on ELCON, see Appendix D.



This chart describes the FCON program and the additional input files required to produce Class III results for the simulated campaign. Note that the product includes the three types of fuel consumption: MOGAS, diesel, and JP-4 or JP-8. The Class III report provides fuel consumption requirements for approximately 40 to 50 fuel burners in terms of gallons consumed per system per 10-day time period. Also, total theater consumption for the three types of fuel is calculated. For more details on FCON, see Appendix E.



This chart describes what the QUICK COMP program is, the level of detail it can provide, and the input files required to run the program.




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QUICK COMPUTATION PROGRAM
QUICK COMP (cont)

Input Files

- MDSQ FILE*
- ROUNDSB.XXX**
- AMMOR1.XXX**
- AMMOR2.XXX**

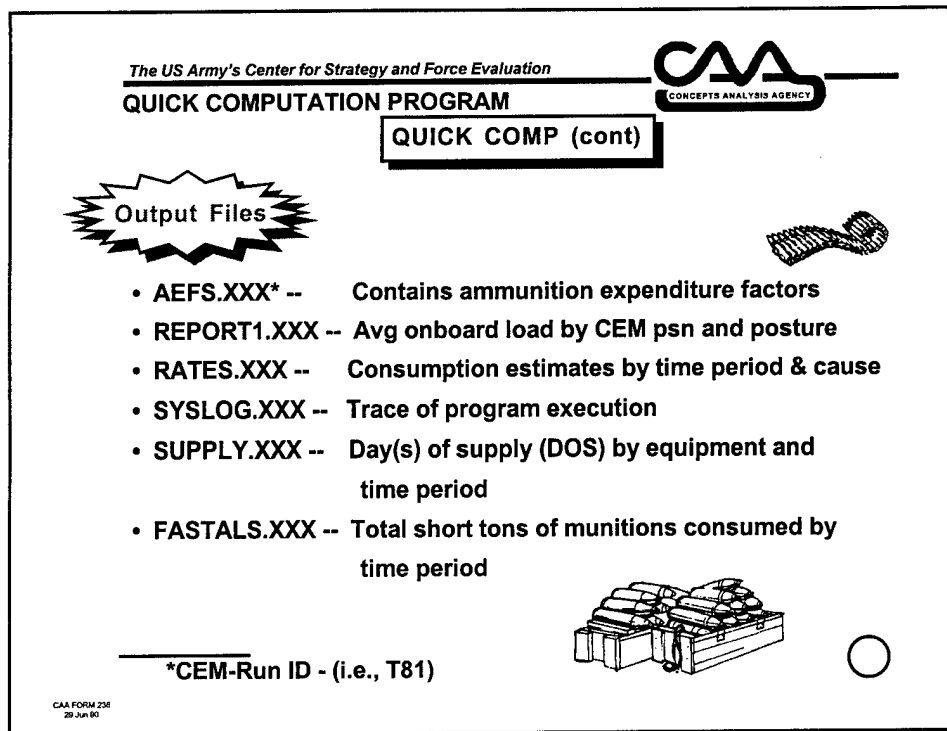
*User-prepared files (CALAPER analyst)

**CEM output files
 (.XXX refers to the CEM run ID, i.e., T81, N05, etc.)



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QUICK COMP input files, continued.




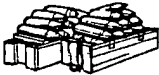
This chart describes the output files created by executing the QUICK COMP routine. For more details on this program, see Appendix F.

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CAA
CONCEPTS ANALYSIS AGENCY

SAMPLE CALAPER OUTPUT FILES

- MCON: Class V Report (Consumption by time period)
Distribution of Requirements (DOR) report
- ELCON: Class VII Consumption/Attrition Reports
(with/without - logistical losses)
(losses by time period)
- FCON: Class III Consumption Reports
(equipment consumption by time period)
(fuel consumption by type, i.e., MOGAS, (DIESEL, J-P4 & J-P8)
- QUICK COMP: Ammunition Expenditure Factors (AEFS.XXX)
REPORT1.XXX (Avg onboard load by CEM)
RATES/XXX (Consumption by time period and cause)
SYSLOG.XXX (Trace of PGM Execution)
SUPPLY.XXX (DOS by equipment and time period)
FASTALS.XXX (Total short tons of ammo by time period)

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This chart summarizes the variety of reports generated by the CALAPER process. Most important are the Class III, V, and VII reports, which are normally provided to the study sponsor on diskette, sorted by munition DODAC and equipment LIN. The other reports are essential in explaining various phases of the campaign consumption and attrition and are invaluable in answering "what if" or "why are the expenditures and/or losses so low/high for this particular system" which invariably follow each WARREQ study iteration.

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SUMMARY

CALAPER is a process:

- Capitalizes on detailed campaign analysis and simulations at the tactical and theater level.
- Develops projected requirements for Classes III, V, and VII at the DODAC and LIN level of detail.
 - Modeled systems
 - Nonmodeled systems
 - Add-on requirements
- Rigorous, detailed, auditable



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In summary, CALAPER is a process (not a simulation or model). It consists of four subroutines: the MCON (Class V), the ELCON (Class VII), and the FCON (Class III). The fourth subroutine (QUICKCOMP) is a facsimile of the entire process but produces results only at the level of detail that CEM can provide. CALAPER needs the detailed tactical and theater-level simulation results to be operational. It develops requirements for modeled and nonmodeled systems (i.e., 400+ weapon/munition combinations, 1,700+ equipment items, and 40+ fuel burning items of equipment. It is rigorous, goes into extensive detail, and provides an audit trail for checking on irregularities of inconsistencies in the simulation results.

APPENDIX A
CONTRIBUTORS

QRA TEAM

a. QRA Director

Mr. Frank O. Gould, Operational Capability Assessments - Southwest Asia

b. Team Members

Mr. David E. Williams, Operational Capability Assessments - Southwest Asia

c. Reviewer

COL James L. Hillman, Chief, Operational Capability Assessments - Southwest Asia

APPENDIX B

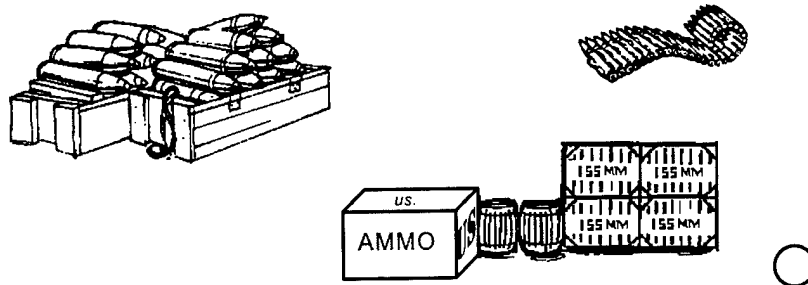
REQUEST FOR ANALYTICAL SUPPORT

P A R T 1	REQUEST FOR ANALYTICAL SUPPORT			
	1. Performing Directorate/ Division: SWA		2. Account Number: 96142	
	3. Type Effort (Enter one): Mode (Contract=C) <input type="checkbox"/> <input checked="" type="checkbox"/> R		4. Tasking (Enter one): <input checked="" type="checkbox"/> V	
	S - Study Q - QRA P - Project R - RAA M - MMS		F - Formal Directive I - Informal V - Verbal	
	5. Title: DETAILED CALAPER BRIEFING			
	6. Acronym: DCB		7. Date Request Received:	
	8. Date Due: 12/01/96		9. Requester/Sponsor (i.e., DCSOPS): N/A	
	10. Sponsor Division (i.e., SSW, N/A)		11. Impact on Other Studies, QRA, Projects, RAA: None	
	12. Product Required: Briefing Charts (Scripted briefing)			
	13. Estimated Resources Required:		a. Estimated PSM: 3.0	
b. Estimated Funds:		c. Models Req'd: N/A (WARREQ-FY03 results will be the base.)		
d. Other:		14. Objective(s)/Abstract: To develop a detailed briefing of the Calculation of Ammunition, Petroleum, and Equipment Requirements (CALAPER) process. Similar to the detailed Ammunition Post Processor (APP) prepared and presented to N.G. OTTSTOT, Ammunition MGR, Ft Leavenworth, KS, in June 1988. Purpose is to illuminate the interactions of the CALAPER routines and programs; to illustrate the interactions with the two supporting combat simulations, COSAGE and CEM; and to trace four or five critical munitions thru the process from beginning to end.		
15. Study Director/POC:		Last Name: GOULD		
First: FRANK		Date: 08/12/96		
Signature: <i>Frank O Gould</i>		Phone#: 295-1617		
GO TO BLOCK 20 If this is A STUDY. See Tab C of the Study Directors' Guide for preparation of a Formal Study Directive.				
P A R T 2	16. Background/Statement of Problem*: This analysis was developed as an in-house project for the purpose of providing a detailed description of the Agency's process for computing materiel requirements in support of HQDA and other MACOM studies.			
	17. Scope of Work*: The analysis envisioned no requirements for new computer simulations. All assumptions, input data files, and guidance provided by the sponsor, ODCSOPS - DAMO-FDL, remained the same. The recently completed Ammunition Requirements Working Group (ARWG) workshop was the basis for the effort.			
	18. Issues for Analysis*: a) To describe the various parts of the CALAPER Process in terms of each of the subroutines involved with Munitions, Equipment, and Fuel Consumption/ATTRITION. b) To show the interaction of CEM and COSAGE input data.			
	19. Milestones/Plan of Action*: Aug 96 - Sep 96 . . . Gather necessary data files and program codes. Oct 96 . . . Draft briefings on each subroutine. Nov 96 . . . Prepare memorandum report and draft scripted briefings. Dec 96 . . . Publish and distribute memorandum report.			
	20. Division Chief Concurrence:		Date: 13 Aug 96	
	21. Sponsor (COL/DA Div Chief) Concurrence: N/A		Date:	
22. Sponsor Comments*:				

The US Army's Center for Strategy and Force Evaluation



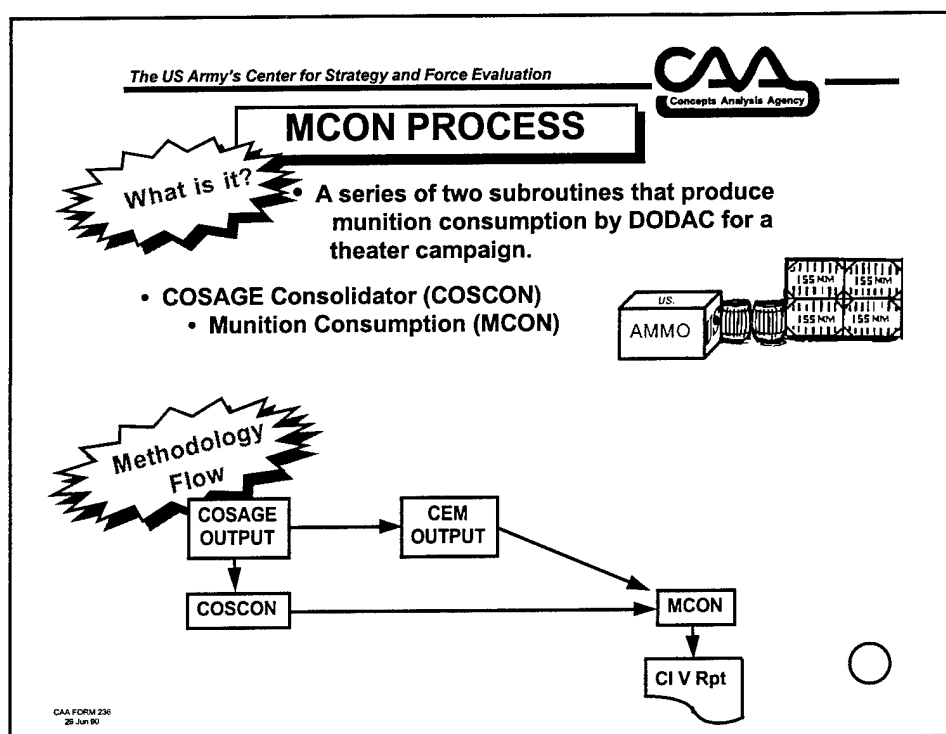
MUNITION CONSUMPTION PROGRAM (MCON)





CAA FORM 206
20 Jun 90

APPENDIX C

MUNITIONS CONSUMPTION PROGRAM (MCON)



This chart describes what the MCON program is, what it does, and shows the methodology flow of data.


<i>The US Army's Center for Strategy and Force Evaluation</i>		 Concepts Analysis Agency
COSAGE OUTPUT FILES REQUIRED		
MCON		
<u>SIMU</u>		
7	--	Arty shot records by fuze
16	--	Arty shot records
47	--	Mine field & FASCOM expenditures
55	--	Direct fire shot records
64	--	List of valid COSAGE wpns, equip, & munitions
65	--	Unit engagement & withdrawal reports
<small>CAA FORM 236 29 Jun 90</small>		

These are the COSAGE files (results) that are needed to execute the MCON.


The US Army's Center for Strategy and Force Evaluation


COSAGE CONSOLIDATOR PROGRAM

(COSCON)



- MCON uses actual expenditures from the theater simulation (CEM) and desegregates these expenditures based on the tactical combat results (COSAGE).
- COSCON provides this info, and:
 - formats the data for input into MCON
 - summarizes direct fire expenditures by shooter/tgt combinations
 - summarizes indirect fire expenditures by fuze, and prop chg by type
 - number of arty missions by type:
 - » counter-battery
 - » reseed
 - » point missions
 - mine consumption data
- COSCON is individually run for each COSAGE replication (16 replications/sample & 7 samples/theater = 112 + COSCON runs)
- COSCON output files
 - example






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29 Jun 90

The COSCON subroutine consolidates the information from each COSAGE replication concerning munition expenditures and equipment losses (for both Red and Blue forces) and formats this data for input into the MCON. An example of a COSCON output files is shown on the next chart.

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 Concepts Analysis Agency

SAMPLE COSCON OUTPUT FILE

*1	3																		
	UM1A2	2	1	116															
	UM2A2	2	1	204															
	UH155Z	2	0	36															
	*END																		
*2	3																		
	UM2120																		
	UGUN25																		
	UTW2BG																		
	*END																		
*3	4																		
	M829-2	DF																	
	M830-2	DF																	
	UTW2BV	DF																	
	M107	HE																	
	*END																		
*4	4																		
	M3A1																		
	M4A1																		
	M119A2																		
*5	2																		
	UM1A2	UM2120	116																
	UM2A2	UGUN25	204																
	*END																		
*6	2																		
	UM1A2	UM2120	M829-2	RT72MR	10.19														
	UM2A2	UTW2BV	UTW2BV	RBMP3M	6.5														
	*END																		
*7	2																		
	UH155Z	M483A1	ICM	0.0	0.0	1671.0													
	UH155Z	M107	HE	561	160	0.0													
	*END																		
*8	2																		
	UH155Z	M107	HE	M119A2	93.81														
	UH155Z	M483A1	ICM	M3A1	1671.0														

○

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This chart shows a sample of the COSCON output file. This file consists of 11 segments designated by an asterisk (i.e., *1 3). The second digit indicates how many records are to follow in that segment of the file. *Segment 1* contains one record for each weapon platform (vehicle) with field 1 = veh name, field 2 = side (1=Red, 2=Blue), field 3 is a direct fire (DF) flag (1=DF in COSAGE, 0=otherwise), and field 4 = number of vehicles onhand at the start of the simulation. *Segment 2* contains one record for each DF weapon. *Segment 3* contains one record for each munition simulated, giving the munition name and type. *Segment 4* contains one record for each propellant charge (PROP CHG). *Segment 5* contains one record for each DF vehicle/weapon combination plus the initial starting densities. *Segment 6* contains one record for each DF vehicle/weapon/munition/target vehicle combination and the average number of shots fired. *Segment 7* contains one record for each indirect fire (IDF) vehicle/ munition combination, to include the type of munition and the number of shots (projectiles) fired using point detonating (PD), veritable timed (VT), and mechanically timed (MT) fuses. *Segment 8* contains one record for each IDF vehicle/munition/propellant charge combination and the number of shots fired. *Segment 9* has one record for each Blue type COSAGE unit with the number of daytime and nighttime engagements and number of daytime and nighttime withdrawals. *Segment 10* contains a record for each Blue type minefield (MF) with the MF length (in meters) and density of mines. *Segment 11* contains one record for each IDF vehicle with the number of smoke, illumination, and other rounds fired, plus the number of FASCAM missions fired at point, reseed, and counterbattery targets.

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COSCON AVERAGER PROGRAM

CAVE

What does it do?


- Averages the results of each segment (11 total) of the COSCON output file for each (7) COSAGE sample.
- Executes in less than 2 minutes for 16 COSAGE replications.
- Output -- same format as the COSCON output files

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29 Jun 90



As the name implies, CAVE averages the results of each segment of the COSCON output file for each COSAGE sample and provides final results in the same format as the COSCON output files.

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CEM OUTPUT FILES REQUIRED


<u>File</u>	<u>Description</u>
Rounds	(Rounds model fired in anger)
Engage	(Used to create posture profiles)
LOGREP	(Logistical data)
AMMO R1	Provides daily info on nos of equipment (Blue & Red) engaged and hit for each of 6 equip categories (pers, tanks, APCs, helo, AT/Ms, arty)
Blue Force Input	Contains the unit deployments (Used to create arrival schedule for each modeled system)

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29 JUN 90

The next input files required for CALAPER are output files from the theater campaign model, CEM, which are shown on this chart.


<p>The US Army's Center for Strategy and Force Evaluation</p>		
<p>CALAPER INPUT FILES REQUIRED</p>		
<p>MCON</p>		
<ul style="list-style-type: none"> • Weapon/munition list* 		<p><u>Source</u></p> <p>HQ, DA, ODCSOPS</p>
<ul style="list-style-type: none"> • Nonsimulated munition files consumption factors (8): <ul style="list-style-type: none"> - Suspect tgt factors - Support tgt factors - Onboard loss factors - Functional checks - Zeroing - Registration - Rear area security (RAS) - Logistical losses <ul style="list-style-type: none"> » Intra-theater » Inter-theater 		<p>HQ DA Staff</p> <p>TRADOC</p> <p>MACOMs</p> <p>FISOs</p> <p>Prgm Mgrs, etc.</p> <p>RCIF, ODCSOPS, WGs</p>
<p><small>CAA FORM 236 29 Jun 90</small></p>		
<p>*Does not appreciably change from study to study.</p>		

Once the two combat simulations are completed and the necessary output files acquired, the CALAPER analyst must also prepare certain user input files as described on the next two charts.

<i>The US Army's Center for Strategy and Force Evaluation</i>		
CALAPER INPUT FILES REQUIRED (cont)		
MCON		
	<u>Source</u>	
• Master File	Backbone of MCON program Lists all wpns, equip, munitions, used by the program. Provides reference pointers used by the program.	
• Control Program*	Controls execution of the MCON. Contains parameters such as # days in the simulations, print switches, format for rate/consumption tables, etc.	
*Does not appreciably change from study to study.		○
<small>CAA FORM 238 29 Jun 90</small>		

CALAPER input files, continued.

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Concepts Analysis Agency

SAMPLE WEAPON/MUNITION LIST

<u>WPN/MUNITION</u>	<u>WPN LIN</u>	<u>MUNITION</u>		
		<u>SSN</u>	<u>DODAC</u>	<u>CBT LOAD</u>
• TANK, CBT, FT 120mm GUN (M1A1)	T13168	-	-	
- CTG, 120mm, HEAT-MP-T (M830)	-	E73201	1315C787	13
- CTG, 120mm, APFSDS-T (M829)	-	E73101	1315C380	27
- CTG, .50 CAL, 4API/1TR, LNK	L91701	E06903	1305A576	900
• INF FIGHTING VEH (IFV) M2A2	F440375			
- TOW IIB, ATGM	-	C59403	1410 PB93	7
- 25mm GUN, CTG, APFSDS-T	G96797	E08210	1305A986	540
- 25mm GUN, CTG, HEIT	G96797	E08201	1305A975	360
• LAUNCHER, MLRS, M270	L44894	-		
- RKT, DPICM (PODS)	-	C65401	1340H104	24/BN
- RKT, ATACMS	-	C98500	1340PL81	54/BN
- RKT, SADARM (PODS)	-	C67900	1340H117	(TBD)

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The study weapon/munition list is key to the process since this is the file that identifies each weapon system to be simulated (by LIN) and also identifies the munitions to be simulated for the specified time period (by SSN and DODAC). One final item of data included in this file are the combat loads for each munition type. (Very important for days of supply (DOS) calculations and on-board loss calculations.) There are approximately 400 individual weapon/munition combinations in the current weapon/munition list.


The US Army's Center for Strategy and Force Evaluation				 Concepts Analysis Agency	
MCON MASTER FILE EXTRACT					
RATE ID NO.	WPN SYS NOMENCLATURE	COMPUTATION SWITCH	WEIGHT IN LBS	LOGISTICS LOSS FACTOR	
1	RIFLE, 5.56mm, M16A2	1			
	MUNITION NOMENCLATURE	TYPE CATEGORY*			
	CTG, 5.56mm, BALL, M855	1	00.05	00.11	
	MUNITION SSN	WPN LIN	MUNITION DODAC		
	E0 4601 XXXXXX	R95 035	1305A 059		
2	RIFLE, 5.56mm, M16A2	1			
	CTG, 5.56mm, TRACER, M856	1	00.05	00.04	
	E0 4602 XXXXXX	R95 035	1305A 063		
:	:	:	:	:	:

* <u>Type Category</u>		<u>Acronyms</u>
0 - don't read entry	6 - historical munition	CTG - Cartridge
1 - modeled munition	7 - arty/mortar - smoke/illum	SSN - Special Study Number
2 - associated munition	8 - FASCAM munitions	LIN - Line Item Number
3 - engineer munition	9 - mine munitions	DODAC - Dept of Defense Ammunition Code
4 - small battle materiel		

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This file identifies each weapon/munition combination by a specific ID number and associates the LINs, SSNs, category of calculation, and other data associated with that specific rate ID number. There are six categories of munitions consumption subroutines within the MCON program. Method 1 includes all weapon systems and munitions that are modeled (or associated) in both simulations; CEM and COSAGE. It also includes data for indirect fire, fuse and propellant charge information and FASCAM munitions. Method 2 includes all engineer barrier and denial materiel data, engineer unit capability data, and is used to produce the majority of the bulk rate munitions data. Method 3 includes all small unit battle data, with expenditure rules for items such as handgrenades and pyro-techniques. Method 4 lists all historical reference data for nonmodeled weapons/munitions such as pistols, sniper rifles, etc. Method 5 contains all indirect fire smoke and illumination round data. Method 6 contains data on minefields such as GEMSS, VOLCANO, and barrier minefields.

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NONSIMULATED MUNITIONS FACTORS

Suspect Target Factors *

Sample


	PERCENT ADD-ONS			
	DEF INT	DELAY	ATTACK	STATIC
M1A1 Tank				
120mm gun	.06	.05	.04	.03
50 cal mg	.10	.09	.75	.01
M2A2, 1FV				
25mm cannon	.25	.45	.20	.10

* Actual numbers are classified CONFIDENTIAL, these numbers are representative only.

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These policy add-ons are percentages of total consumption to be added to the modeled consumption rates coming from CEM. For example, if the IFV fired 1,000 rounds of 25mm Bushmaster ammunition during a period of defense intense conflict, then CALAPER would add 25 percent or 250 rounds for suspect targets for a total of 1,250 rounds for that period of consumption.



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NONSIMULATED MUNITIONS FACTORS (cont)

Support Target Factors



Sample

	<u>PERCENT ADD-ONS</u>			
	<u>DEF INT</u>	<u>DELAY</u>	<u>ATTACK</u>	<u>STATIC</u>
MLRS				
DPICM-RKT	0.9	0.7	0.5	.03
155mm How				
HE Projectile	.074	.05	.08	.01
105mm How				
HE Projectile	.08	.03	.06	.02

○

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In the theater simulation, indirect fire weapons only fire at maneuver units. We know that in actual combat, artillery will also fire at combat support and combat service support units if they can be acquired and engaged. To account for these types of consumption, a percentage of the total modeled consumption (by posture) is also added on, similar to the suspect target add-ons described on the previous chart.

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NONSIMULATED MUNITIONS FACTORS (cont)		
Onboard Loss Factors		
<u>Type of Loss</u>	<u>Loss Factor</u>	
Catastrophic kills (K-Kills)	100% onboard load	
Temporary kills (M or F Kills)	30% onboard load*	
<hr/>		
*Assumption is that 30% of the onboard load of rounds on the damaged wpn system would be unsafe to fire.		
		
CAA FORM 236 29 Jun 90		


Onboard loss factors apply only to direct fire systems such as tanks, helicopters, BFVs, etc. At the time CALAPER and its predecessor, the APP, were designed, the only indirect fire system capable of having projectiles onboard was the 155mm SP how, M109, with 22 projectiles. This is an area of possible change, since most SP artillery systems now have their own artillery support vehicles (FASVs) collocated with the howitzers and could be subject to losses from enemy counterbattery fires.

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CAA Concepts Analysis Agency	
NONSIMULATED MUNITIONS FACTORS (cont)	
Functional Checks	
<u>Wpn Sys</u>	<u>Rds/Wpn/Day</u>
M16AZ Rifle	10
Squad Auto Wpn (SAW)	10
7.62 & cal .50 MGs	10
20mm & 30mm cannon (HELOs)	10
25mm BUSHMASTER	10

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Certain direct fire systems, as shown above, are assumed to fire the number of rounds shown, each day in order to ensure that the weapon is functioning, i.e., especially critical in cold weather regions, or in the desert or jungle climates.

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NONSIMULATED MUNITIONS FACTORS (cont)


Zeroing

<u>Wpn Sys</u>	<u>Rds/Wpn</u>
<u>Tanks</u>	
HEAT RDS	1
APFSDS RDS	2
<u>Helicopters</u>	
20 & 30mm cannon	10
2.75-in RKTS (HE)	2
<u>25mm cannon & BUSHMASTER</u>	10
<u>7.62 & cal .50 MGs</u>	50
<u>Squad Auto Wpn (5.56mm)</u>	30
<u>M16A2 rifle</u>	18

○

CAA FORM 236
 29 Jun 90


For each deploying weapon system indicated above, the assumption is that the gunner will zero the weapon system upon deployment into the theater. If a weapon system is damaged and repaired, it will be zeroed again before it is reissued or replaced into a replacement pool. Once issued from a replacement pool, it would be zeroed again by the receiving unit.

The US Army's Center for Strategy and Force Evaluation		 Concepts Analysis Agency
NONSIMULATED MUNITIONS FACTORS (cont)		
Registration		
<u>Type unit</u>	<u>No. & type daily registration</u>	<u>No. Projectiles</u>
Arty Btry	1 abbreviated HE	7
Mortar section	1 HE	6

○

CAA FORM 736
29 Jun 90

Artillery/mortar units in the combat simulations only fire at maneuver units. To account for displacements and registration of the artillery pieces, the rules listed above apply. These have been greatly reduced since the WARRAMP Study days (circa 1985 - 1991), due to the introduction of advanced technology on the battlefield of such systems as the AN/TVQ-2, Ground/Vehicular Laser Helicopter Designator (G/VLLD), the PLRS (Position Location Reporting System) and the ADDS (Army Data Distribution System), a real-time battlefield communication system.


The US Army's Center for Strategy and Force Evaluation		 Concepts Analysis Agency	
NONSIMULATED MUNITIONS FACTORS (cont)			
Rear Area Security			
Rifle, M16A2	200 rds		
Squad Auto Wpn (SAW)	800 rds		
Machine guns			
7.62mm, M60	800 rds		
7.62mm, IFV MTD	4400 rds		
7.62mm, CFV MTD	7600 rds		
25mm cannon (BUSHMASTER)	900 rds		
Helicopter Systems			
7.62 minigun	3000 rds		
20mm cannon	194 rds		
30mm cannon	350 rds		
2.75-in Rkts	14 rkts		

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CAA FORM 236
29 Jun 90

Certain systems, shown above, are assumed to fire one combat load of munitions on the move from the port/airfield up to the FLOT in a rear area security (RAS) mission, since this type of operation is not simulated in CEM.


The US Army's Center for Strategy and Force Evaluation


Concepts Analysis Agency

NONSIMULATED MUNITIONS FACTORS (cont)


Logistical Losses

- Intratheater losses (DCSLOG)
 - % add-ons range from .02 to .06
- Intertheater losses
 - based on latest Navy Sealift studies




CAA FORM 238
28 Jun 90

Once total consumption of munitions is calculated based on all of the causes discussed in earlier charts, two more additions are made. The first, intratheater losses, accounts for those losses from the port/airfield to the FLOT due to guerrilla actions, accidents, fires, etc. The second, intertheater losses, accounts for those losses occurring to ships or aircraft moving equipment and supplies from CONUS to the theater of operation. Since the Soviet Union is no longer considered a threat, with its formidable submarine fleet and also medium bomber threat, those losses have been zeroed out. Potential enemy forces such as North Korea or Iraq, are not assumed to pose a threat to US deployments with their primary coastal naval forces. In summary, none of these add-ons appreciably change from study to study, unless a particular issue arises. The latest change in recent years involved accidental damages to MLRS rocket pods. A review of the Persian Gulf war after-action reports revealed that approximately 5 percent of the pods were damaged in movement from the ports to the firing batteries. Accordingly, CALAPER input files were adjusted to reflect these losses.

The US Army's Center for Strategy and Force Evaluation		 Concepts Analysis Agency	
MCON CONTROL FILE			
Record No.			
1 - 90	08	06	09
2 - T F T 1 1 (Theater model used: T (CEM) F (FORCEM); T = O/H qty, F = auth qty; T = include K-kills, F = don't include K-kills in O/B losses; last day of MOB period; 1st day of report period)			
3 - 42 (CEM PSN, that defines personnel)			
4 - 0.38 T (% damaged wpns repaired in GS maint)			
5 - 7 T T F T T T T T T T T T } Print switches for various output tables			
.			
.			
8 -	001	011	021 031 041 → 081 (first day of each time period)
9 -	010	020	030 040 050 → 090 (last day of each time period)
10 - BAPD BAHD RAPD RAHD RAD STAT (COSAGE sample postures)			
11 - BAPD BAHD BAD RAPD RAHD RAD STAT RSRVE (CEM postures)			
12 - 001 - (number of data records to follow, for sea loss data)			
13 - 001 090 000 (first day of loss period, last day of loss period, loss rate)			

This file controls the MCON program. It defines the length of the campaign, the number of CEM postures, COSAGE samples, numbers of time periods to be reported, and other output table information to be printed. An explanation of the entries in record number one is as follows: the first is the number of days of simulation; the second is the number of CEM postures; the third is the number of COSAGE postures; and the fourth is the number of time periods.

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Concepts Analysis Agency

SAMPLE MCON OUTPUT

TANK, M1A1, FT, 120mm GUN

CTG, 120mm, AFPSDS-T, M829A1

PERIOD	1-10*	11-20
AVG AUTH QTY	54	108
PWE (CTGS)	125	290
PWE WEIGHT (TONS)	4.3	10.1
RATE (RDS/TUBE/DAY) ¹	0.23	0.27
CUMULATIVE CONSUMPTION	125	415
CBT LOAD ²	2160	4320
ATP REQ (MAX 3 DOS) ³	37.3	87.5
ASP REQ (MAX 10 DOS) ⁴	124.4	291.6
THEATER REQ (MAX 30 DOS) ⁵	372.6	874.8
TOTAL REQ ⁶	2819.3	5873.8

CAA FORM 236
29 Jun 80

This chart shows a sample of the MCON output, or the "VREPORT.XXX."
 *Calculations for the period 1-10 are shown below.

- 1 Rate = consumption/(avg auth qty)(no days in period)

$$\text{Rate} = 125/54 \times 10 = 0.23 \text{ ctgs/tank/day}$$
- 2 Cbt load = 54 tks x 40 ctgs/tk = 2,160 ctgs
- 3 ATP = (rds/tk/day) (no. tanks) (3 days) =

$$\text{ATP} = (0.23)(54)(3) = 37.3 \text{ ctgs}$$
- 4 ASP = (rds/tk/day) (no. tanks) (10 days) =

$$\text{ASP} = (.23)(54)(10) = 124.4 \text{ ctgs}$$
- 5 Theater rqmt = (rds/tk/day)(no. tanks)(30 days) =

$$(0.23)(54)(30) = 372.6 \text{ ctgs}$$
- 6 Total rqmt = PWE + cbt ld + ATP + ASP + theater rqmt

$$= 125 + 2,160 + 37.3 + 124.4 + 372.6$$

$$= 2,819.3 \text{ ctgs}$$

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MCON SUMMARY

- **MCON is the CALAPER subroutine that produces munition consumption for approximately 400 wpn/munition combinations by equipment (LIN) and munition (DODAC) for a theater campaign**
- **It consists of two subroutines called the COSCON and the MCON**
- **It requires output files from COSAGE and CEM, plus several user-prepared files unique to CALAPER**

CAA FORM 256
29 Jun 90



The US Army's Center for Strategy and Force Evaluation

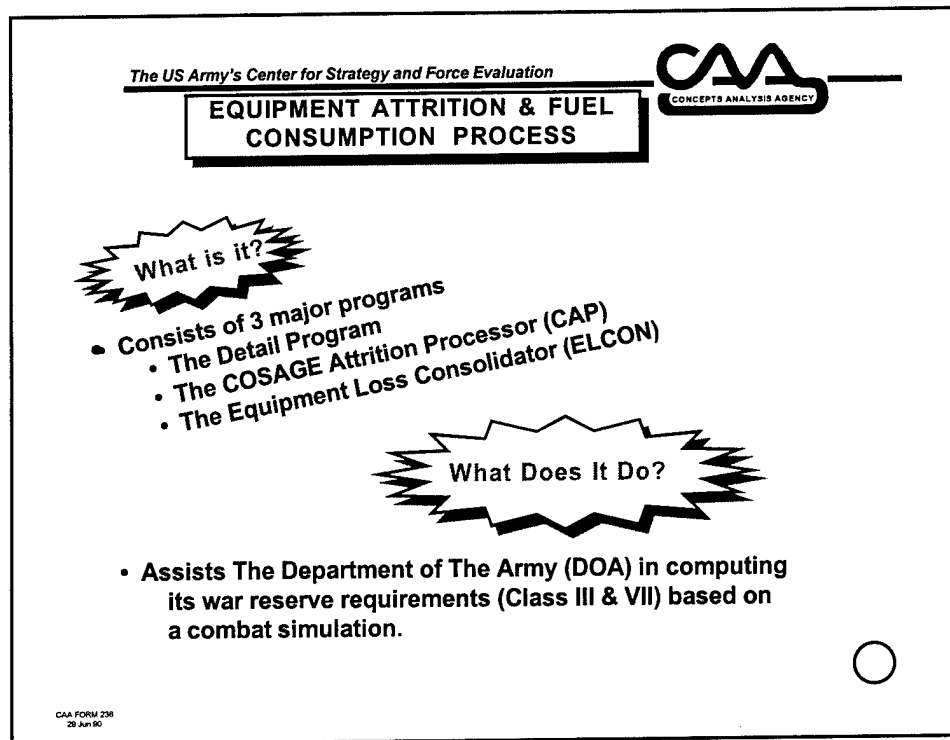


EQUIPMENT LOSS CONSOLIDATOR (ELCON)

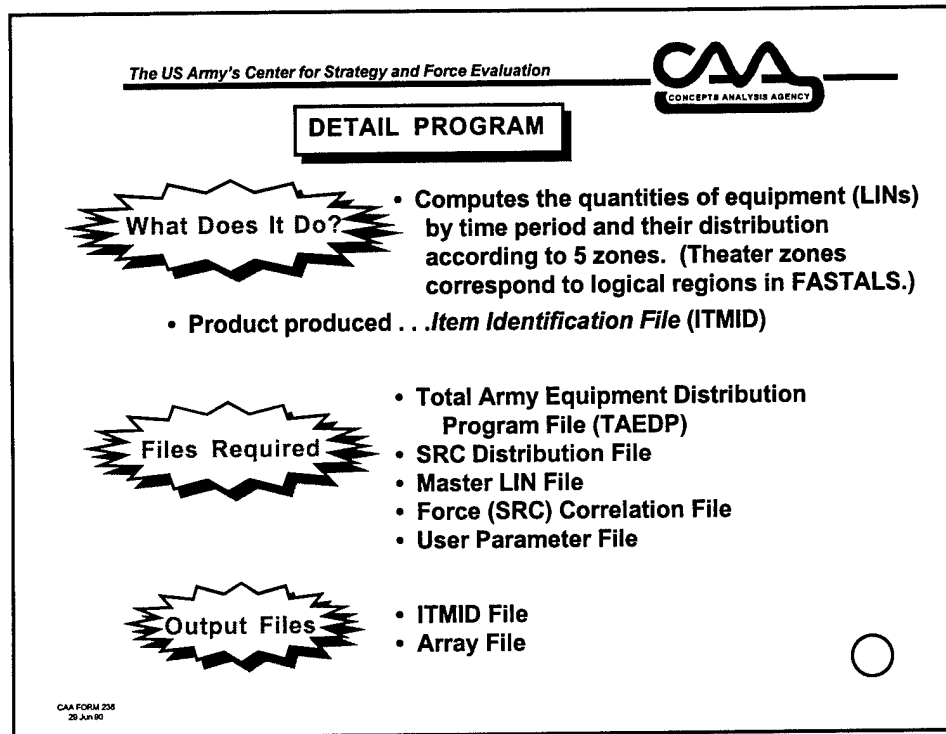


APPENDIX D

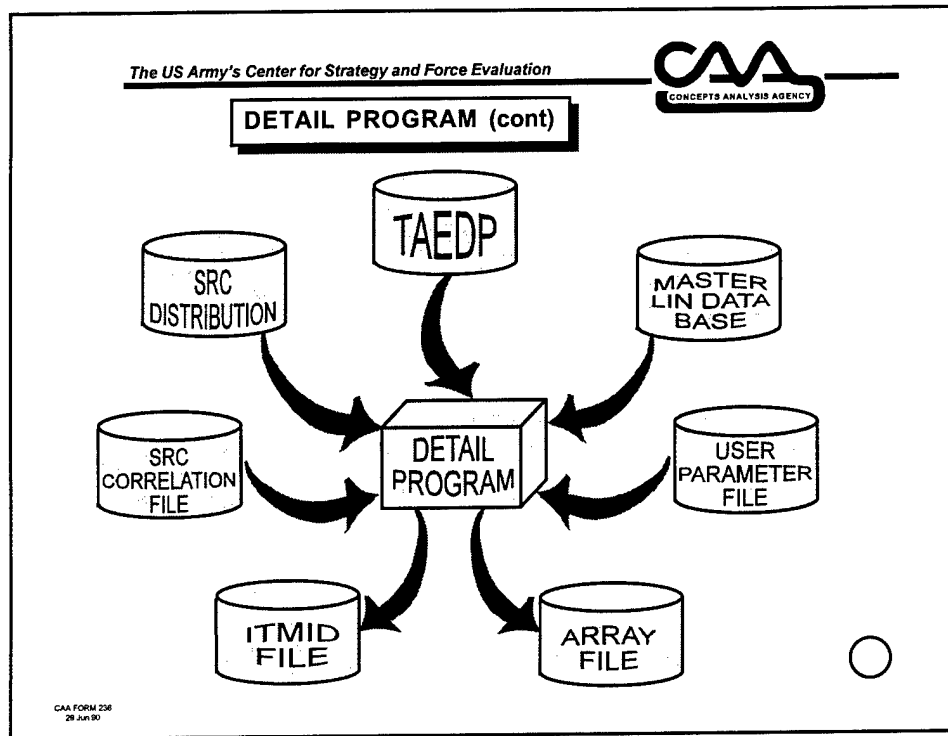
EQUIPMENT LOSS CONSOLIDATOR (ELCON)



This chart describes what the ELCON is, and what it does.



The first ELCON subroutine is the DETAIL program. This chart shows what the DETAIL program does, the input files required, and the results or output files produced.



The flow of input data for the DETAIL program is shown here. Each of these input (file/data) sources will be discussed in more detail.

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SAMPLE TAEDP FILE EXTRACT

<u>Equip LINs</u>	<u>Time periods</u>					
1 - AO3198	39.5	60.5	60.5	74.6	74.6	74.6
2 - B18648	33	44	46	88	90	90
3 - C18481	3	27	29	42	42	42
4 - T13168	54	54	108	216	270	324
5 - L44894	9	9	27	54	108	108
.
.
.

CAA FORM 208
28 JUN 80

The TAEDP file lists the quantities of each LIN or MIE as it is deployed into the MRC by time period.

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 CONCEPTS ANALYSIS AGENCY

SAMPLE SRC DISTRIBUTION FILE

SRC	Description of unit	Percent in zones*				
		1	2	3	4	5
01185 J400	ATK, HEL BN, AH-1S	0.00	0.30	0.30	0.20	0.20
05115 H300	ENGR BN, HV	0.30	0.40	0.30	0.00	0.00
06445 H100	ARTY BN, 155mm SP	0.00	0.70	0.30	0.00	0.00
07045 H020	INF BN, MECH	0.60	0.30	0.10	0.00	0.00
.
.

*Zones: 1 = 0 - 1 km (FLOT)
 2 = 1 - 8 km (DIVISION CBT)
 3 = 8 - 30 km (DIVISION SPT)
 4 = 30 - 50 km (CORPS SPT)
 5 = 50+ km (COMMZ)

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CAA FORM 206
29 Jun 90

This file shows the distribution of the various SRCs in the five zones of the battlefield in percentages. The distance from the FLOT back to each zone is also indicated on the chart.

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SAMPLE MASTER LIN FILE

<u>LIN</u>	<u>Nomenclature</u>	<u>Vulnerability category</u>
H31110	Helicopter, observation, OH-58C	1
F40375	Infantry Fighting Veh, IFV, M2A2	3
L44894	Launcher, Rocket, Armored Veh Mounted, MLRS	5
K57667	Howitzer, Medium, SP, 155mm M109	5
J35813	Generator set, dsl engine, 5 Kw, 60 Hz	18
T13168	Tank, Cbt, Full Tracked, 120mm gun, M1A1	3
X40009	Truck, Cargo, 2 1/2 ton, 6 x 6 w/e	5
.	.	.
.	.	.
.	.	.

CAA FORM 236
28 Jun 90

This file describes each LIN type of equipment for which requirements are to be generated. It also provides a brief description of the item and the vulnerability category in which it belongs.

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USER PARAMETER FILE

What Is It?

- This is the Control File for the Detail Program.
- Sample Parameter File

Record No.	Sample Entry	Definition
1 -	007	Indicates number of time periods
2 -	001	No. tapes used for TAEDP data base
3 -	99999	Max no. records in TAEDP data base
4 -	0000 2466 SIMU19	Contains a '0000', a tape no. to assign, and a file code to assign to tape no
5 -	DEBUG, 01	A SWITCH TO PRINT DEBUG PRGM STATEMENTS: (1=ON, 0=OFF)
6 -	SELECTION DATE: 990931	CALENDAR DATE FOR M-day (31 Sep 1999)
7 -	D.DAY = M.DAY + x	NO. DAYS OF MOBILIZATION
8 -	NUMBER.TIME.PERIOD.DAYS. .FOR EACH.PERIOD	Character string indicating next set of information
9 -	1 0 1 0 1 0 1 0 1 0 1 0	Length (in days) of each time period
10 -	E 1 2 4 9 Z	A list of the Valid Army Deployment Control Code (ADCCO) - terminated by letter "Z"

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CAA FORM 236
28 Jun 90

This is the control file for the DETAIL program. It includes data such as the number of time periods to be reported, TAEDP data base information, D-day and M-day relationships for the campaign, and other data necessary to execute the program.

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USER PARAMETER FILE (cont)

• Sample Parameter File

<u>Record No.</u>	<u>Sample Entry</u>	<u>Definition</u>
11 -	HEADER.TAPE.NUMBER 3422	(Not currently used. An Integer is still required)
12 -	TRACING.LIN T13374	Used to track computation for a particular LIN (M1 tank, 105mm)
13 -	ADD.IN.ON.HAND 0	A switch to add onhand quantities to the data base. 0 = DON'T ADD 1 = ADD QUANTITIES
14 -	M-day = DAY.NUMBER 01	Day of mobilization relative to selection date. (Typically set to 1.)

CAA FORM 238
28 Jun 90

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FORCE CORRELATION FILE

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CONCEPTS ANALYSIS AGENCY


Record No	SRC	Logical Region Assigned	No of UIC Records to Follow	Latest Arrival Date	UIC	Unit Description	No of COSAGE Type Units w/which this UIC is associated
1 -			0024				
2 -	03447 L000	2		30	KA0365	CO, NBC Def	2
3 -	05147 L000	1		1	KA0512	CO, ENGR BN	1
COSAGE Unit Name Correlation Factor							
4 -	UATPL	0.0714					
5 -	05079 J200	2		23	KA0520	CO, ENGR BN	0
6 -	06365 L400	1		26	KA0803	BN, ARTY, 155mmSP(3x6)	2
7 -	UATPL	0.0833					
8 -
.
.

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CAA FORM 206
29 Jun 91

This file shows the relationship of the force SRCs, their associated UICs, and the stylized COSAGE units being simulated. A description of the unit is also provided as well as the correlation factor (ratios of weapon systems being considered).

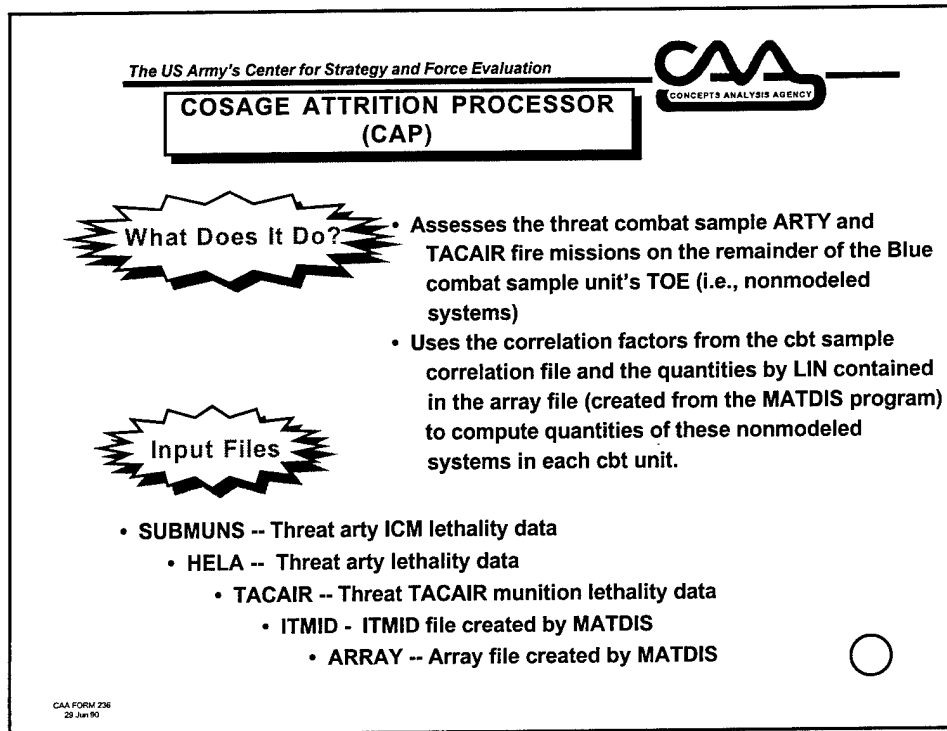
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SAMPLE ITMID FILE

Record No.	LIN	NOMENCLATURE
1 -	A21633	HCPTTR SCOUT; OH-58
AVERAGE QUANTITY OF THE ITEM IN EACH TIME PERIOD		
2 -	0026	0026 0026 0026 0041 0060 0064
DISTRIBUTION BY ZONE AND TIME PERIOD		
3 -	0.14	0.86 0.00 0.00 0.00
4 -	0.14	0.86 0.0 0.0 0.0
5 -	0.14	0.86 0.0 0.0 0.0
6 -	0.14	0.86 0.0 0.0 0.0
7 -	0.14	0.86 0.0 0.0 0.0
8 -	0.14	0.86 0.0 0.0 0.0
9 -	0.14	0.86 0.0 0.0 0.0
	⋮	⋮ ⋮ ⋮ ⋮
10 -	C18234	CARR PERSNL FULL TRK; M113A1
11 -	0051	0051 0051 0151 0169 0239 0249
12 -	0.57	0.15 0.26 0.01 0.01
	⋮	etc.,
	⋮	etc.,
	⋮	etc.,


The ITMID file describes the LIN and nomenclature of the item of equipment and the average quantity of the item deployed in each time period. It also shows the percentage of distribution of the item in each of five zones of the battlefield for each time period. For example, in the chart above the OH-58 helicopter had an authorized level of 26 aircraft in theater during the first 10-day time period and gradually increased to a total of 64 aircraft authorized by the seventh 10-day time period. For each of these time periods, 14 percent of the aircraft are projected to be located within 0-1 km from the FLOT, and the other 86 percent are projected to be within 1-8 km from the FLOT. Similar information is shown for a second item of equipment, a M113A1, APC.



This chart, and the next, describes what the CAP subroutine does and the input files required to execute the program.

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COSAGE ATTRITION PROCESSOR
(CAP) (cont)


 CONCEPTS ANALYSIS AGENCY

More Input Files

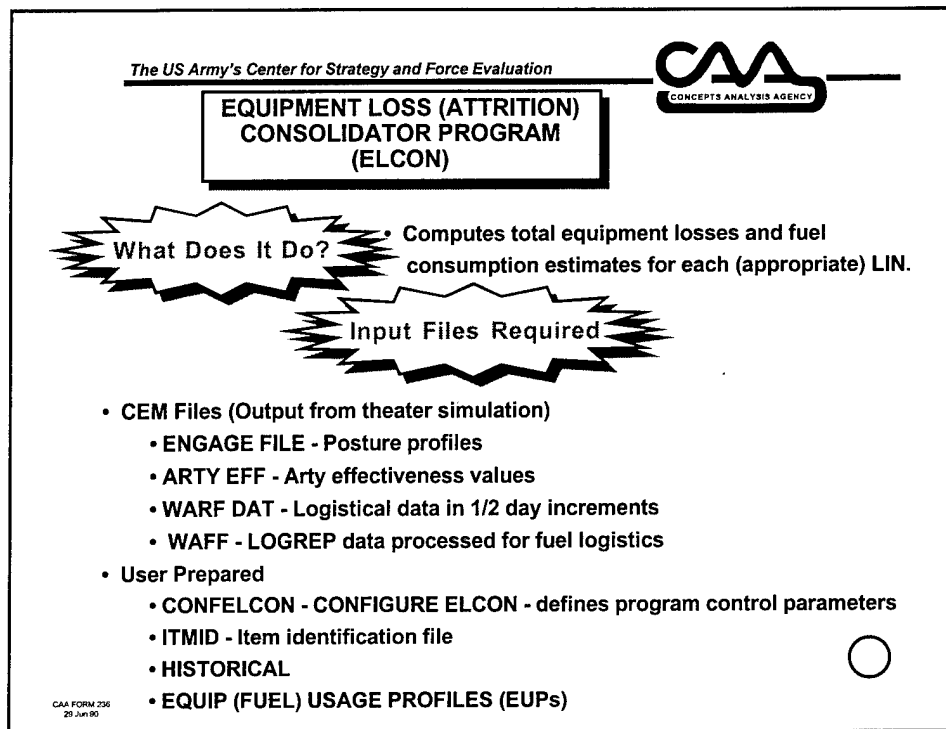
- UNIT – COSAGE unit file
 - CATTU – COSAGE Category Type Unit (CATTU) file
 - PEM – COSAGE Posture - Environment - Mission (PEM) file
 - MUNS – COSAGE Munitions (MUNS) file
 - TBTRY – COSAGE Type battery (TBTRY) file
 - SIMU4

COSAGE OUTPUT FILES – Threat arty & TACAIR shot records

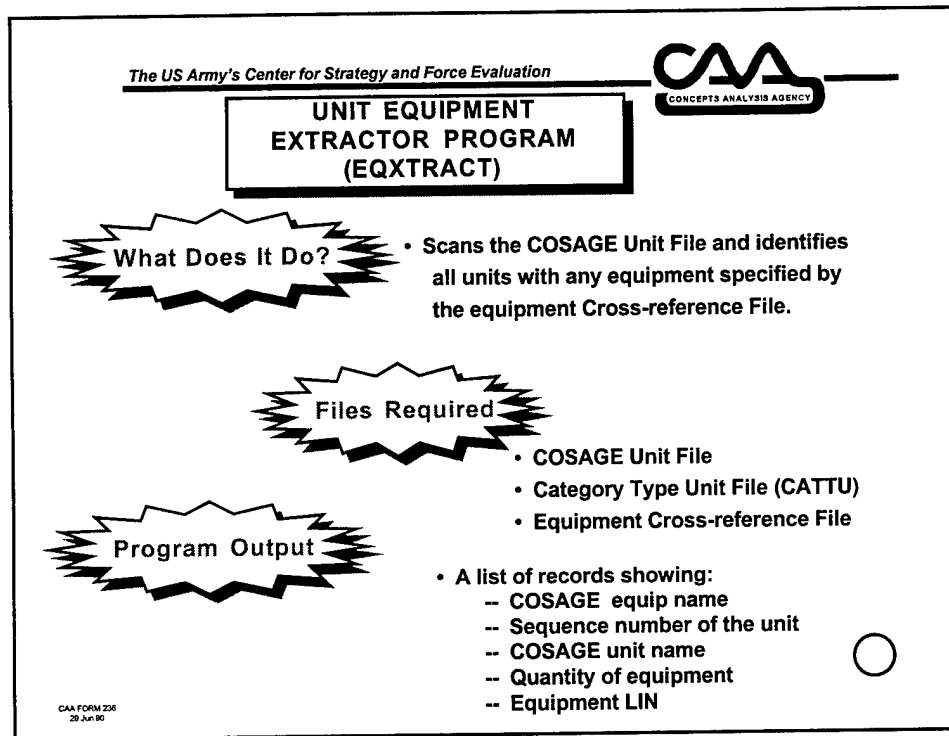
CAA FORM 236
29 Jun 90



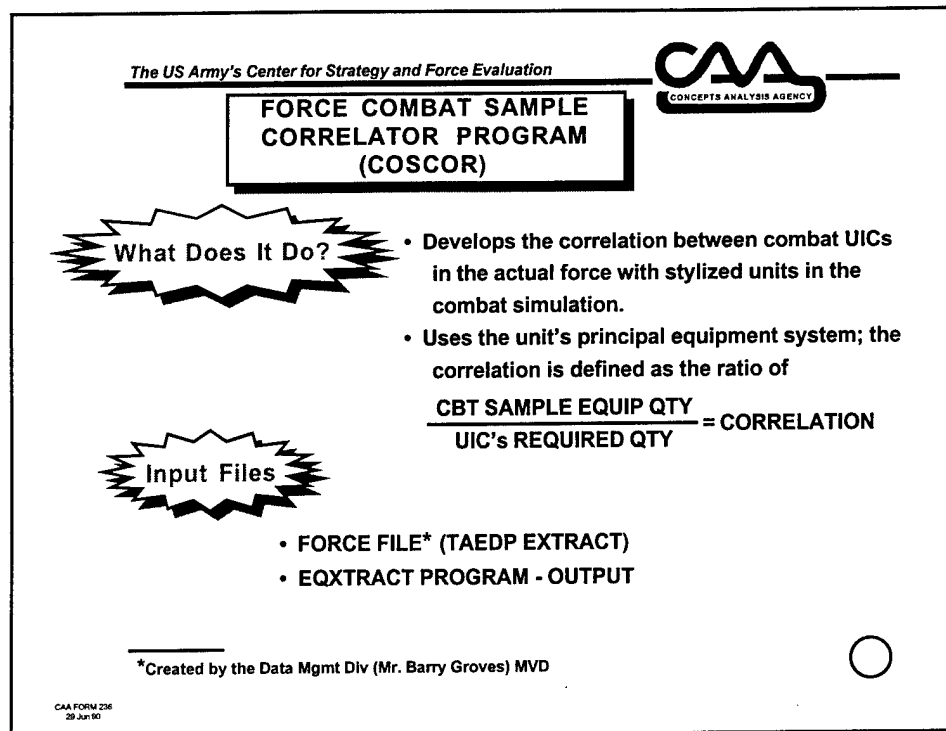
The CAP description continued.



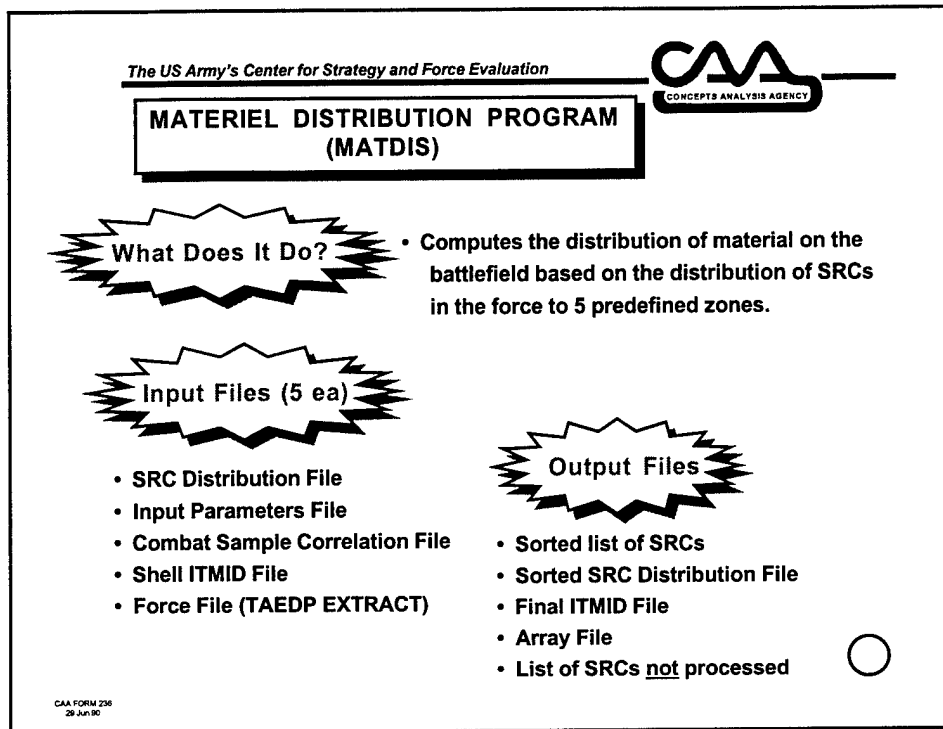
This chart shows specifically what the ELCON subroutine does and the input files required to execute the program.



This chart describes what the EQXTRACT subroutine does. This is the program that links the COSAGE unit files and the real-world TOE files of the SRCs comprising the trooplist of units to be deployed into the MRC.



This chart shows what the COSCOR subroutine does and the input files required to execute it. Essentially, COSCOR develops the linkage between the COSAGE stylized units that are simulated and the actual combat UICs of the combat force. This is extremely important when considering the nonmodeled items in the actual UICs involved.



This chart shows what the MATDIS subroutine does and the input files required to execute the program. Also shown are the output files created by the program.

<p>The US Army's Center for Strategy and Force Evaluation</p> <p>VULNERABILITY CATEGORIES</p> <ul style="list-style-type: none">• A list of 22 vulnerability categories into which all MEI are placed, (approx 1700).• A notional item in each category is selected to represent the loss criteria for that category.• This list is periodically reviewed by the Logistics Division, HQ, USAMSAA for updates.• This is a Key File in computing losses of nonmodeled systems. <p>CAA FORM 236 28 Jun 90</p>	<p>CAA CONCEPTS ANALYSIS AGENCY</p>
--	--

Only 25 to 30 (US) weapon systems are actually modeled throughout the process in both COSAGE and CEM. The actual equipment list for which requirements are generated contains over 1,700 items. Therefore, most of these systems are not modeled and must be accounted for by the methodology. To account for all of these systems, each MEI is placed into one of 22 vulnerability categories. For each category, a notional item is identified, and every other item in that category is assumed to be attrited as is that notional item. Then, in the ELCON process, and specifically the CAP subroutine, when the COSAGE Red artillery and TACAIR results are overlaid onto the remainder of the sample units TOE (nonmodeled systems), a percentage of attrited items can be estimated based on the vulnerability category of the equipment and the correlation factors established earlier. Finally, in addition to these losses, historical loss rates are added for such things as accidents, rear area actions, and others.

The US Army's Center for Strategy and Force Evaluation



VULNERABILITY CATEGORIES
 (22 EACH)

<u>Vulnerability Category</u>	<u>Group Title</u>	<u>Notional Item</u>
1	LIGHT AIRCRAFT	HELO, LIGHT OBSV
2	LIGHT ARMOR	APC, M113
3	MED/HVY ARMOR	COMBAT TANKS
4	LIGHT VEHICLES	TRUCK, 1/4 TON
5	MED/HVY SELF-PROPELLED VEHICLE	TRUCK, 2 1/2 & 5 TON
6	RADAR	RADAR, TPQ-36
7	LT TOWED EQUIP	TLR, CARGO, 1/4 TON
8	TOWED ARTY	HOWITZER, (T) 105, 155mm
9	MED/HVY TOWED EQUIP	SEMI-TLR, 12-TON
10	MED RECOVERY VEH	RECOVERY VEH, M88A1
11	LT RECOVERY VEH	RECOVERY VEH, M578
12	AMMO TRANSPORTERS	CARRIER, CARGO, 6-TON, M548

CAA FORM 236
28 Jun 90

This chart and the next chart list the 22 vulnerability categories used by the ELCON program.

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VULNERABILITY CATEGORIES
 (cont)

<u>Vulnerability Category</u>	<u>Group Title</u>	<u>Notional Item</u>
13	POL TRANSPORTERS	TRUCK, TANK, FUEL SERVICE
14	SMALL ARMS	RIFLE, M16A2, 5.56mm
15	CREW-SERVED WPNS	MG, M60, 7.62mm
16	OPTICAL/ILLUM INSTRUMENTS	NIGHT VISION SIGHTS
17	COMMO/ELECTRONIC DEVICES	RADIO, PORTABLE
18	MACHINES	GENERATOR SET, 5-10KW
19	MISC SMALL EQUIP	ANTENNA, RC-292
20	MED/LG SHOP SETS	SHOP EQUIP, AUTO MAINT
21	POL STORAGE EQUIP	FUEL SYS, SUPPLY POINT, 6000 GAL
22	WATER TANKS	TANK, FABRIC, 2500 GAL

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CAA FORM 238
20 Jun 90

The list of vulnerability categories concluded.

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SAMPLE ELCON OUTPUT

	Period			
	1-10	11-20	21-30	. . .
• A21633 HELO, SCOUT OH-58				
AVG AUTH QTY	24	24	48	. . .
LOSSES W/OL	2.89	4.52	5.94	. . .
LOSSES W/L	3.41	5.07	6.32	. . .
• T13168 TANK, CBT, M1A1				
AVG AUTH QTY	58	58	116	. . .
LOSSES W/OL	3.1	4.6	2.7	. . .
LOSSES W/L	3.52	4.91	3.2	. . .
.
.

CAA FORM 236
29 Jun 90

Projected wartime losses (PWL) are shown for each LIN as appropriate for the duration of the campaign usually in 10-day time periods. Losses are shown without/logistical losses added (W/OL) and with logistical losses (W/L) added.

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ELCON SUMMARY

- **ELCON is the CALAPER subroutine that produces equipment for approximately 1700 MEI. Approximately 25-30 items are actually modeled in the theater combat simulation. All of the other nonmodeled items are estimated based on their vulnerability categories, their location on the battlefield, and historical loss rates.**
- **ELCON consists of three subroutines: The DETAIL Program, COSAGE Attrition Program (CAP), and the Equipment Loss Consolidator Program (ELCON).**
- **It produces equipment requirements (ATTRITION) by time period, for the duration of the campaign.**

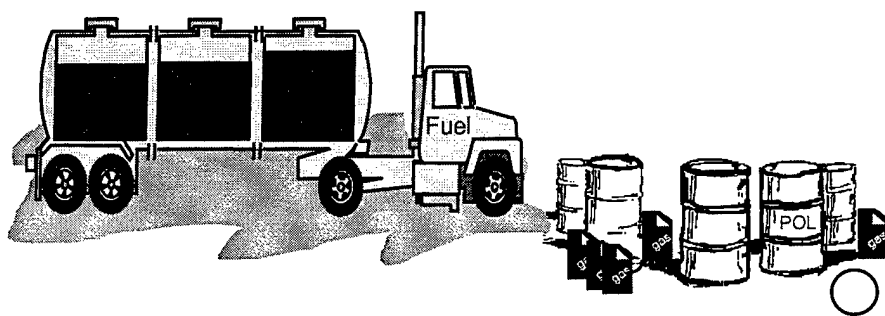
CAA FORM 236
29 Jun 90



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FUEL CONSUMPTION PROGRAM (FCON)



CAA FORM 238
29 Jun 90

APPENDIX E

FUEL CONSUMPTION PROGRAM

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CAA
CONCEPTS ANALYSIS AGENCY

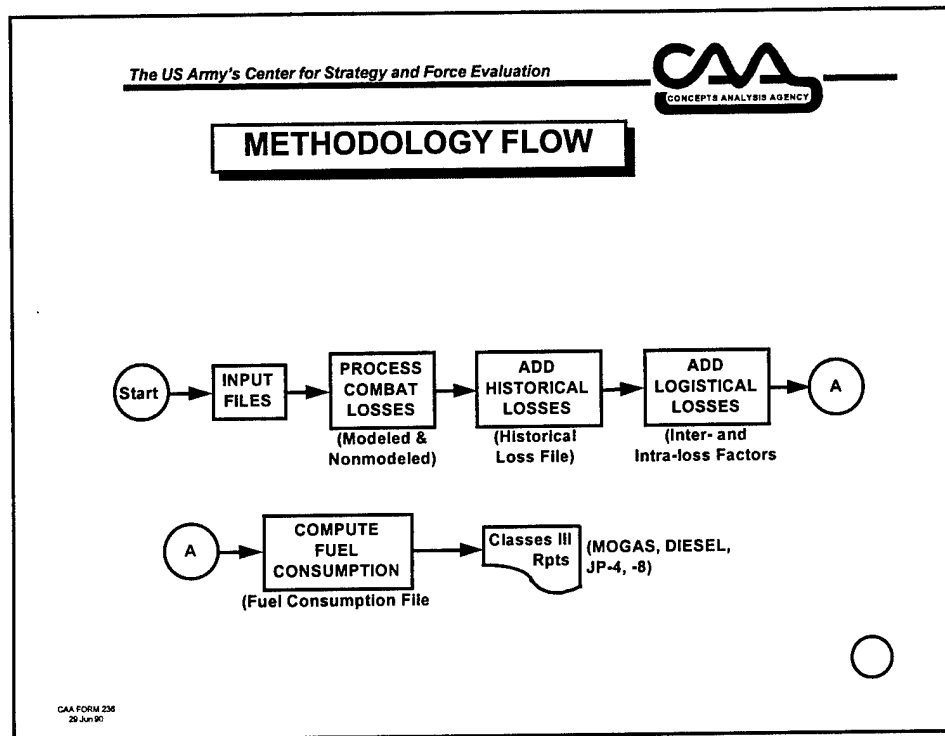
FCON PROGRAM

What is it?

- A routine that calculates fuel consumption for approximately 40-50 fuel burning items of equipment based on a theater campaign
- Develops requirements for 3 types of fuel
 - MOGAS
 - Diesel
 - JP-4, JP-8

CAA FORM 236
29 Jun 90

This chart tells what the FCON program does and the types of fuel consumption it calculates.



This chart shows the methodology flow of data through the program. Many of the ELCON files are also used in this process

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CAA
CONCEPTS ANALYSIS AGENCY

REQUIRED INPUT FILES


- 1 -- Fuel consuming equipment list
- 2 -- Fuel (equipment) usage profiles
- 3 -- Battlefield distribution of usage/losses
- 4 -- Logistical losses

CAA FORM 208
29 Jun 90

This chart lists the unique FCON input files needed to execute the program.

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FCON INPUT FILES



1 – Fuel Consuming Equipment List Source: HQ DA Staff
(Extract)

<u>LIN</u>	<u>Nomenclature</u>	<u>Type Fuel</u>
• T13374	M1 Tank, 105mm Gun	Diesel
• K29694	AH-1S, ATK HELO	JP-4
• J43918	Gen Set, Gas Eng, 1.5KW	MOGAS

2 – Equipment Usage Profile (EUP) Source: USACASCOM
(M1 Tank, 105mm Gun)

T13374 Tank, Cbt, FT M1
105mm Gun

Fuel Tank Size (gal) – 503
Fuel Type – Diesel

	<u>MODE OF OPN</u>				
	<u>IDLING</u>	<u>X-CTRY</u>	<u>SEC.RDS</u>	<u>PRIM-RDS</u>	<u>Other</u>
• Fuel Consumption (gal/hr)	10.80	56.6	44.6	44.6	–
• Usage Rates/Cbt Operation (hrs/day)					
ATK	20.8	1.6	0.9	0.2	–
DEFENSE	11.0	1.0	0.3	0.02	–
DELAY	17.0	2.0	0.5	0.01	–
UNENGAGED	0.0	0.02	0.05	0.0	–

CAA FORM 236
28 JUN 90

Sample FCON input files.

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CAA
CONCEPTS ANALYSIS AGENCY

FCON INPUT FILES (cont)

3 -- Fuel Consumption/Distribution (4 categories)

- Combat Usage
Computed using: daily cbt posture profile
usage profile
- Onboard Losses
 - Remaining fuel onboard is lost when system is destroyed
 - Computed as avg qty of fuel remaining in fuel tank of equipment after 1/2 day of combat usage.
- Maintenance Usage
 - Computed based on unengaged cbt operations for:
 - IDLING - (diagnostics/stationary testing mode)
 - X-CTRY - road testing mode
- Rear Area Usage
 - Based on usage of fuel by equip in the noncombat zone
 - Uses reserve or unengaged combat operation

CAA FORM 256
29 Jun 90

FCON input files sample (continued).

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FCON INPUT FILES (cont)

4 -- Battlefield Distribution of Usage/Losses

Using Group	Usage/Loss Category			
	CBT Usage	Onboard Losses	Maint Usage	Rear Area Usage
<u>Modeled Items</u>				
Daily CBT	Full day	-	-	-
CBT (K-kill)	1/2 day	x	-	-
CBT (M or F Kill)	1/2 day	-	x	-
Non CBT (K-kill)	-	x	-	-
Non CBT (M or F Kill)	-	-	x	-
<u>Nonmodeled Items</u>				
CBT Zone (K-kill)	Full day	-	-	-
CBT Zone (M or F Kill)	1/2 day	x	-	-
Rear Area (Daily)	1/2 day	x	-	-
Rear Area (Remainder)	-	-	-	x


5 -- Logistical Loss Files

Inter- and Intratheater losses

(Same factors as used in MCON & ELCON calculations)



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CONCEPTS ANALYSIS AGENCY

FUEL CONSUMPTION OUTPUT FILE (SAMPLE)

WAFF RATES FOR WARREQ 200X - SWA, BASE CASE (DIESEL FUEL) (GAL/SYS/DAY)

(Diesel)		TIME PERIODS			
<u>LIN</u>	<u>NOMENCLATURE</u>	<u>1-20</u>	<u>21-40</u>	<u>41-60</u>	<u>1-60</u>
C12155	CARR, PERS, FT, ARMD, M111A1	8	10	9	9
F40375	INF FIGHTING VEH, M2A2	45	68	65	59
T13168	TANK, CBT, 120mm, M1A1	39	21	165	75
X40009	TRK, CGO, 2 1/2 T, M35A2	7	12	11	10

(JP4 FUEL)

Lt 28647	HCPTR, ATK, ADV AH-64	404	666	662	544
A21633	AERIAL SCOUT HCPTR, OH-58D	74	112	111	99

(MOGAS FUEL)

J43918	GENR SET GAS ENG 1.5KW	3	6	5	5
K24862	HEATER DUCT TYPE PTBL	41	66	39	49

(TOTAL PERIOD CONSUMPTION OF FUEL BY FUEL TYPE (IN GALLONS))

TOTAL JP4	1,417,929	1,270,408	1,267,664	3,956,001
TOTAL DIESEL	2,400,834	2,553,845	2,284,507	7,239,186
TOTAL MOGAS	500,792	497,190	512,025	1,510,007

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28 Jun 90

This chart shows a sample FCON output file (fuel consumption results) for various LINs and the three types of fuel consumed.

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**FUEL CONSUMPTION
OUTPUT FILE (CONT)
(SAMPLE)**
**WARTIME FUEL USAGE SUMMARY FOR WARREQ-OX-SWA) BASE CASE
(AVG DAILY CONSUMPTION OF FUEL (ALL TYPES) BY CATEGORY (IN GALLONS))**

<u>TIME PERIOD:</u>	<u>1-20</u>	<u>21-40</u>	<u>41-60</u>	<u>1-60</u>
CBT MEAN	27,138	46,513	45,898	41,791
NONCBT MEAN	187,658	349,981	355,763	298,739
MAINT MEAN	4	24	25	16
ONBOARD MEAN	1,177	5,625	4,734	3,632

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FCON output file sample (continued).

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FCON SUMMARY

- FCON calculates fuel consumption for approximately 40-50 fuel burning items of equipment based on a theater campaign.
- It provides consumption (gals/system/period) by LIN, normally in 10-day time periods.
- It develops requirements for three types of fuel: MOGAS, DIESEL, and JP-4/-8.

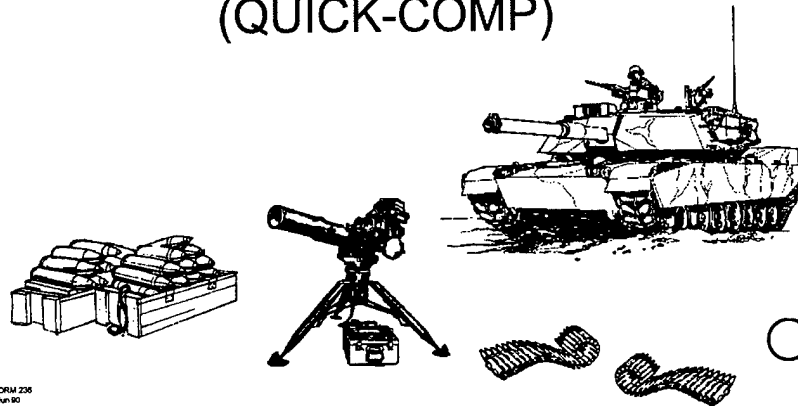


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29 Jun 90

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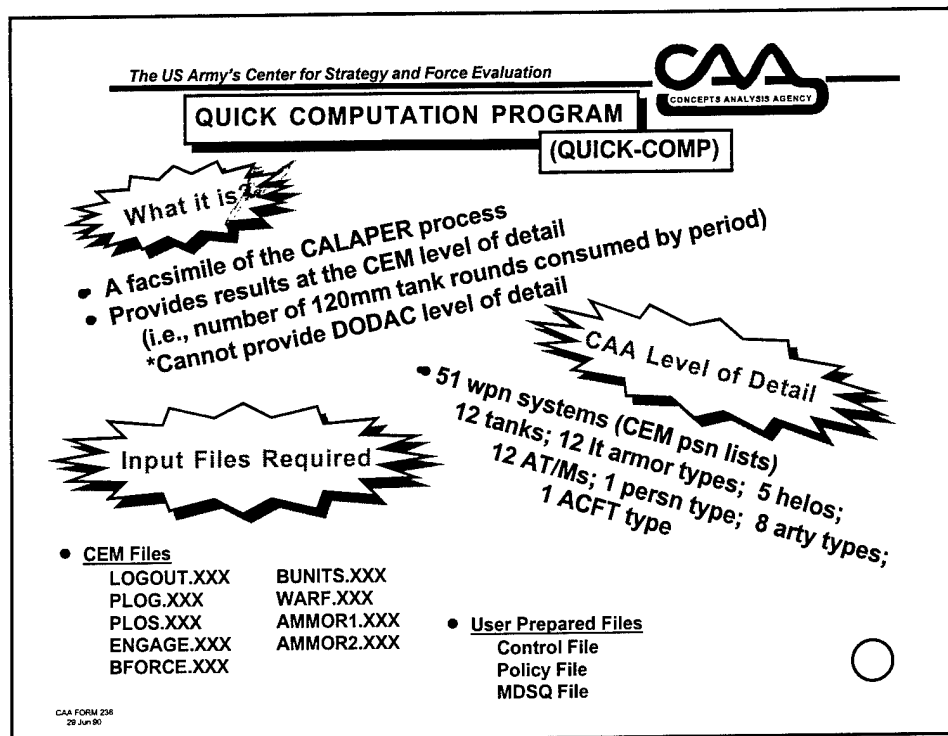
QUICK COMPUTATION PROGRAM (QUICK-COMP)



CAA FORM 226
29 Jun 90

APPENDIX F

QUICK COMPUTATION PROGRAM (QUICK COMP)



This chart describes what QUICK COMP is, the input files required to execute it (note that only CEM runs are necessary), and the level of detail the program can provide. It is a handy tool for quickly answering what-if type questions concerning munition consumption and equipment attrition resulting from a theater campaign.


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CAA
CONCEPTS ANALYSIS AGENCY

QUICK COMPUTATION PROGRAM (cont)

- Output Files
REPORT1.XXX
RATES.XXX
SYSLOG.XXX
SUPPLY.XXX
FASTALS.XXX


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20 JUN 90



This chart shows the QUICK COMP files produced as output.

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QUICK COMP - CONTROL FILE



SAMPLE: CONTROL FILE

RECORD

1 - TRUE - - - - - (True - Use Authorized Level; False - Use on level)

2 - FALSE- - - - - (True - Use K-kills only for onboard losses;
(False - Use M/F & K-kills)

3 - 60- - - - - (No days in CEM Simulation)

4 - 1- - - - - (No of time periods)

5 - 60 3 7 10- - - (Last day of 1st time period; no days of supply for ASPs;
no DOS for ATPs; No. DOS for theater stocks)

6 - 1- - - - - (No records to follow which define sea loss curves)

7 - 1 60 0.00- - - (1st day loss rates apply; last day loss rates
apply; loss rate)


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28 Jun 90

The first user prepared file controls the execution of the QUICK COMP program. Is is *important* that the length of the simulated campaign agrees exactly with the CEM results or the program will *abort*. Record numbers 6 and 7, sea loss rates, only applied when the USSR was the threat force.

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QUICK COMP - POLICY FILE


 CONCEPTS ANALYSIS AGENCY

SAMPLE FILE


CEM WPN P&N NO.	CEM AMMO POT	BURST SIZE (# OF RDS)	FUNCTION CHECKS	ZEROING FACTOR	LOG LOSS FACTOR	MUNITION LOAD (CBT)	MUNITION WEIGHT (LBS)	EQUIP LOSS FACTOR	Comment Field
1 1	01.00	0.00	3.00	0.06	40.0	69.0	.05		TANK 1 MAIN GUN
Suspect TGT BAD BAPD BAHD MEETING RAHD RAPD RADL STATIC Factors 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00									
Support TGT Factors 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00									
1 2	5.00	10.00	50.00	0.06	900.0	0.05	0.0	0.05	50 CAL MG on Tank 1

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CAA FORM 226
28 Jun 90

This second user-prepared file describes the relationship between the CEM weapon position list, and the corresponding ammunition pots (1 and 2). It also sets the suspect and support target factors (percent add-ons) for each weapon system modeled, by posture. It finally states the munition logistical loss factors, the munition combat load, munition weight (in pounds), and the equipment loss factor for the LIN. The comment field gives the nomenclature of the system and the generic munition type.

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QUICK COMP - MDSQ FILE


CEM WPN POSITION	CEM AMMO POT	WPN COMBAT LOAD	MDSQ FACTOR (ODCSOPS)
1	1	40.	3
1	2	900	3
13	1	7.	3.
13	2	900	3.
25	1	12	2.
25	2	76	2.
44	1	234	10.
44	2	-1*	10.
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*a negative entry means to ignore this data set, i.e., there is no second weapon pot for this arty system.

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CAA FORM 206
28 Jun 95

This file provides the data for calculating the minimum distribution system quantity (MDSQ) data and days of supply data as output. For example: CEM weapon position 1 refers to the M1A1 tank. CEM ammunition position 1 are all of the 120mm tank round expenditures and ammunition position 2 refers to the .50 cal machine gun expenditures. The MDSQ factors are the ODCSOPS derived factors which are used as multipliers of the HQDA determined weapon combat loads, in order to calculate MDSQ of munitions necessary to defeat the threat force, provide sustainability (i.e., fill up the logistical pipeline), and to prepare combat units for the next mission - readiness, which equates to a full combat load onboard at the end of the current campaign.




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QUICK COMP - OUTPUT FILES

QWIK-REPORT.XXX


	<u>Sample periods</u>			
	<u>1-10</u>	<u>11-20</u>	<u>21-30</u>	
<u>M1A1 Tank (USA)</u>				
Auth Level	.00	207	259	.....
Losses	.00	11.44	2.84	.....
Cumulative losses	.00	11.44	14.28	.....
 <u>WEAPON: 120mm RD</u>				
Consumption rate (rds/tube/day)	.00	1.11	0.38	.....
Period cbt consumption	.00	2296.22	979.52	.....
Cumulative cbt consumption	.00	2296.22	3275.74	.....
Cbt load	.00	8288.00	10360.00	.....
ASP requirement	.00	688.87	545.96	.....
ATP requirement	.00	1607.35	1273.90	.....
Theater stockage level	.00	6888.66	5459.56	.....
Cumulative theater requirement	.00	19769.10	20915.16
Total tonnage consumed	.00	880	382
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CAA FORM 236
28 Jun 90

These next two charts show a sample output file, the QWIK-REPORT.XXX, for two weapon systems--an M1A1 tank and an OH-58D attack helicopter.

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CONCEPTS ANALYSIS AGENCY

QUICK COMP - OUTPUT FILES (cont)

QWIK-REPORT.XXX

	<u>Sample periods</u>			
	<u>1-10</u>	<u>11-20</u>	<u>21-30</u>	
<u>OH58D (USA)</u>				
Auth Level	16	16	29	.....
Losses	0.11	0.00	0.11	.....
Cumulative losses	0.11	0.11	0.22	.....
<u>WEAPON: HELLFIRE MSL</u>				
Consumption rate (rds/tube/day)	2.01	0.80	0.13	.....
Period cbt consumption	321.90	128.36	38.65	.....
Cumulative cbt consumption	321.90	450.26	488.91	.....
Cbt load	64.00	64.00	116	.....
ASP requirement	96.57	38.51	13.97	.....
ATP requirement	225.33	89.85	32.60	.....
Theater stockage level	965.70	385.08	139.69	.....
Cumulative theater requirement	1673.51	1027.70	850.90
Total tonnage consumed	155	95	79
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CAA FORM 206
29 Jun 90

Sample QWIK-REPORT.XXX (concluded).

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QUICK COMP - SUPPLY.XXX REPORT

	<u>Time periods</u>			
	<u>1-10</u>	<u>11-20</u>	<u>21-30</u>	
<u>CEM SYSTEM #1</u>				
Auth Level	39.00	273.00	513.00
Losses	0.11	3.51	2.62	.....
Cumulative losses	0.11	3.51	6.13	.....
<u>AMMO POT #1</u>				
Consumption rate (rds/tube/day)	1.59	0.31	0.25	.....
Period combat consumption	620.10	851.88	1271.55	.....
Cumulative combat consumption	620.10	1471.98	2743.53	.....
Combat load	1560.00	10920.00	20520.00	.....
ASP requirement (3 DOS)	186.03	245.56	384.75	.....
ATP requirement (10 DOS)	620.10	851.88	1271.55	.....
Theater stockage leve (30 DOS)	1860.30	2554.64	3884.65	.....
Cumulative theater requirement	4186.53	4503.96	6812.50	.....

CAA FORM 238
20 Jun 80

This report provides data for each CEM weapon system and each ammunition pot of consumption. Items include the average authorized TOE quantities of systems/time period, the consumption rate, and the various days of supply information for each echelon of ammunition stockage.

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QUICK COMP - FASTALS REPORT

		<u>Time periods</u>			
		<u>1-10</u>	<u>11-20</u>	<u>21-30</u>	
CEM EQUIP #1	GUN #1	15.97*	33.76	113.71
CEM EQUIP #1	GUN #2	1.68	3.69	12.01	.....
CEM EQUIP #2	GUN #1	16.59	46.047	5.07	.....
CEM EQUIP #2	GUN #2	1.56	4.561	0.72	.....
.
CEM EQUIP #51	GUN #2	0.00	0.00	0.00
FASTALS MODEL					
<u>FIRST</u>	<u>LAST</u>	<u>TOTAL</u>			
1	10	1201.68*			
11	20	5395.67			
21	30	21134.32			
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.	.	.			

*All numbers reflect tonnage of munitions consumed/expended

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CAA FORM 238
 29 Jun 90

This report shows the weapon/munition tonnages consumed for each time period of the campaign. It also shows total tonnages of all munitions for each time period. This data is used in workload generation for CS and CSS units in FASTALS.

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**QUICK COMP - RATES FILE**

CEM WPN PSN	CEM AMMO POT	CONSUMPTION TYPE	Time periods		
			1-10	11-20	21-30	
1	1	EXPEND	95.58	326.41	384.31	.....
1	1	SUSPECT	9.56	32.64	38.43	.....
1	1	SUPPRT	0.00	0.00	0.00	.....
1	1	OBLOAD	165.87	632.94	967.74	.....
1	1	ANZERO	210.00	25.56	1919.91	.....
1	1	FCHECK	0.00	0.00	0.00	.....
1	1	LOG	28.86	61.05	205.54	.....
1	1	SEA	0.00	0.00	0.00	.....
1	1	REQ	509.87	1078.60	3631.33	.....
1	1	LOAD	40.00	40.00	40.00
1	1	LOSSES	4.20	16.80	9.45
1	1	LEVEL	14.00	70.00	634.00
1	1	RATE	3.64	1.54	0.57
		

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28 Jun 90

This rates file provides the consumption/expenditures for each munition type simulated by CEM position and ammunition pot. It also give the distribution of consumption/expenditures by cause, i.e., expended in the model, suspect and support target add-ons, onboard losses, zeroing, functional checks, logistical losses, and intertheater losses (sea losses) if applicable. Finally, it shows the average authorized quantities of the system, by time period (LEVEL), the total consumption (REQ), combat load per system (LOAD), losses per period (LOSSES), and an expenditure RATE per period (total consumption/(# days in period * (avg auth qty of system))).

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QUICK COMP SUMMARY

- **QUICK COMP** is a standalone program that is a facsimile of the entire CALAPER process.
- It is fast in execution, requires only the CEM theater simulation-results, and provides details at the CEM level of detail, i.e., consumption of rounds by type (120mm tank rounds), and attrition of equipment by LIN (approximately 25 - 30 MIE).
- It *does not* calculate fuel consumption.



CAA FORM 238
28 Jun 90

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